

**An investigation of Early Childhood Caries in the lower
socio-economic areas surrounding Tygerberg Oral Health
Centre in order to plan a community appropriate
intervention strategy**

by
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Declaration

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the authorship owner thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

December 2014

Abstract

The long waiting lists for general anaesthesia and sedation services for children with Early Childhood Caries (ECC) at the Tygerberg Oral Health Centre highlighted the problem of ECC in this area. This was confirmed by a retrospective study of patient records at the Centre.

ECC is largely caused by a combination of lifestyle factors, especially feeding and oral hygiene practices. Socio-economic status and parental factors such as education and employment have also been shown to play a role in the development of ECC.

In order to address this problem, a study was designed to determine the prevalence of ECC in children from the lower socio-economic communities which drain to the Tygerberg Oral Health Centre and assess the knowledge of the caregivers of these children. A total of 659 children were examined at crèches and schools as well as community health clinics. The children examined at the clinics accompanied others and did not have any health reason for the visit themselves.

As the aetiology is largely behaviour-driven and children are dependent on their caregivers to meet their basic needs, 366 caregivers attending the community health clinics with their children, were interviewed to determine their practices and knowledge of oral health. A total of 83 health care workers at these clinics were also interviewed to assess their knowledge of oral health matters and determine the role that they can play in the prevention of this disease.

A cross-sectional community survey was carried out by means of clinical assessments and structured interviews with the aid of questionnaires. The survey was divided into 3 parts:

1. Prevalence of ECC amongst the children
2. Knowledge of the caregivers about oral health care
3. Knowledge of health care workers at the clinics in these communities about ECC

The prevalence study revealed that 71.6% of children in the study population presented with caries. This is extremely high and highlights the need for serious interventions. Parents/caregivers were shown to be ill-informed regarding their children's oral health care needs which include dietary and oral hygiene practices as well as how this disease can be prevented. It is clear that caregivers need to be educated regarding feeding practices,

weaning time, dietary content and the importance of basic oral health. The importance of preserving the primary dentition and regular dental attendance also needs to be emphasized in this community where dental health does not seem to be a priority.

Health care workers such as nurses who come into contact with children from an early age would be the ideal vehicle to impart this information. However, as revealed from the results of this study, there is a serious lack of knowledge amongst these professionals regarding oral health matters. Time and resources therefore have to be invested to improve their knowledge and lessen their load so that more emphasis can be placed on prevention. Small changes can make a big difference towards addressing the burden of this disease on the health care system.

Abstrak/ Opsomming

Die lang waglyste vir algemene narkose en sedasiedienste vir kinders met Vroeë Kinderkaries (VKK) by die Tygerberg Mondgesondheid Sentrum het die probleem van VKK in die area uitgelig. Dit is bevestig deur 'n retrospektiewe studie van pasiënterekords by die Sentrum.

VKK word grootliks veroorsaak deur 'n kombinasie van lewenstyl- faktore, veral voeding en mondhigiëne praktyke. Daar is ook aangetoon dat sosio-ekonomiese status en ouerlike faktore soos opvoeding en werkstatus 'n rol speel in die ontwikkeling van VKK.

In 'n poging om hierdie probleem aan te spreek is 'n studie onderneem om die prevalensie van VKK in kinders van laer sosio-ekonomiese gemeenskappe wat van die Tygerberg Mondgesondheid Sentrum gebruikmaak te bepaal. Die kennis van mondgesondheid van die vernaamste toesighouers van die kinders in die studie is ook bepaal. 'n Totaal van 659 kinders is by crèches en skole sowel as gemeenskapsklinieke ondersoek. Die kinders wat by die klinieke ondersoek is, het nie self 'n gesondheidsrede vir die besoek gehad nie maar het saam met ander mense gekom.

Die etiologie van VKK word hoofsaaklik deur gedrag gedryf en kinders is van hulle toesighouers afhanklik vir hulle basiese behoeftes. Dus is 366 toesighouers wat gemeenskapsklinieke besoek het ondervra oor hulle praktyke en kennis rakende mondgesondheid. 'n Totaal van 83 gesondheidswerkers by die klinieke is ook ondervra oor hulle kennis van mondgesondheid om die rol wat hulle kan speel in die voorkoming van hierdie siekte te ondersoek.

'n Dwarsdeursnit gemeenskaps-opname is uitgevoer deur middel van kliniese ondersoeke en gestruktureerde onderhoude met behulp van vraelyste. Die opname is in drie dele aangepak:

1. Prevalensie van VKK onder die kinders
2. Kennis van die toesighouers oor mondgesondheidsorg
3. Kennis van gesondheidsorgwerkers by die klinieke in hierdie gemeenskappe oor VKK

Die prevalensiestudie het getoon dat 71% van kinders in die studiepopulasie karies gehad het. Dit is baie hoog en het die behoefte aan ernstige ingryping beklemtoon. Ouers/ toesighouers het geblyk om baie swak ingelig te wees oor hulle kinders se mondgesondheid-behoeftes wat dieet- en mondhigiëne praktyke ingesluit het, asook hoe die siekte voorkom

kan word. Dit is duidelik dat versorgers onderrig moet word oor voedingspraktyke, die beste tyd vir soog, dieetinhoud en die belang van basiese mondgesondheid. Die belang van die behoud van primêre dentisie en gereelde tandsorgafsprake behoort ook in hierdie geneemskappe beklemtoon te word, gesien in die lig van die lae prioriteit wat hierdie gemeenskappe op mondgesondheid plaas.

Gesondheidsorgwerkers soos verpleegpersoneel wat reeds in kontak kom met hierdie kinders op 'n jong ouderdom is die ideale persone om sulke inligting te versprei. Dit het egter uit die studie geblyk dat daar 'n ernstige gebrek aan kennis by hierdie professionele persone bestaan oor mondgesondheid. Tyd en hulpbronne sal belê moet word en hulle werkslading verlig moet word om hulle kennis te verbeter sodat meer klem op voorkoming gelê kan word. Klein veranderinge kan 'n groot verskil maak om hierdie siektelas op die gesondheidsorgstelsel te verlig.

Dedication

To the late Professor Ruth Peters, for her guiding influence, mentorship and the love she has instilled in me for Paediatric Dentistry.

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“No one can whistle a symphony. It takes a whole orchestra to play it.”

~H.E. Luccock

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List of Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
AAPD	American Academy of Pediatric Dentistry
BASCD	British Association for the Study of Community Dentistry
COHSP	Comprehensive Oral Health Service Plan
CPD	Continuing Professional Development
CQI	Continuous Quality Improvement
ECC	Early Childhood Caries
ENT	Ear, nose and throat
HIV	Human Immunodeficiency Virus
HPCSA	Health Professions Council of South Africa
ICDAS	International Caries Detection and Assessment System
ICDAS- LAA	International Caries Detection and Assessment System- Lesion Activity Assessment
MS	Mutans Streptococci
NHANES	National Health and Nutrition Examination Survey
NIDCR	National Institute for Dental and Craniofacial Research
NOHS	National Oral Health Survey
s-ECC	Severe Early Childhood Caries
TB	Tuberculosis
TOHC	Tygerberg Oral Health Centre
VAP	Ventilator Assisted Patients
WHO	World Health Organization

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CHAPTER 1

INTRODUCTION

1.1 Background

Over the years, there has been an overall decline in dental caries throughout the world. This could be attributed to the increased use of fluoridated toothpaste and changes in health care policies which have shifted the focus towards prevention rather than treatment (Van Wyk & Van Wyk, 2010). Improved oral hygiene practices and changes in diet and feeding patterns could also have contributed to this decline.

Despite this declining trend, dental caries however still affects a large percentage of children (Wennhall et al, 2008; Plutzer & Spencer, 2008; Dye et al, 2010). Early childhood caries (ECC) has been recognized by the American Academy of Pediatric Dentistry (AAPD guidelines, 2012-2013a) as a 'significant public health problem' (p.50). Dye et al (2010) stated that dental caries is 'the most common chronic disease of childhood in the United States' (p. 132). Western diets rich in fermentable carbohydrates, parental attitudes and behaviour and low socio-economic status have all been implicated in the disease process (Gussy et al, 2006).

Even though caries in itself is not life-threatening, if left unchecked, abscesses and cellulitis that result from severely decayed teeth can progress to such an extent that it can be life-threatening (Begzati et al, 2010). The extent of this oral health problem is therefore of major significance as it undoubtedly has an impact on general health and well-being and affects the quality of life (Broder, 2007; Wandera et al, 2009; Adeniyi et al, 2009; Plutzer & Spencer, 2008, Petersen et al, 2005; Tinanoff & Reisine, 2009; Abanto et al, 2011).

The health-related quality of life in paediatric populations can be measured using a measurement model such as PedsQL. Four core domains make up the basis of this tool to assess quality of life, i.e. physical, emotional, social and school functioning (Varni et al, 2001; Petersen et al, 2005). Similarly, Tinanoff and Reisine (2009) stated that the term 'quality of life' encompasses 'physiological function, symptoms, social function, psychological well-being as well as economic' factors (p. 397). In short, it refers to how oral health impacts on

an individual's ability to function normally (Abanto et al, 2011). Abanto et al (2011) showed that the severity of ECC and the negative effect it had on the quality of life, was significantly associated with low family income and socio-economic circumstances. These factors should therefore also be taken into consideration when assessing the quality of life.

ECC can undoubtedly impact on the four core domains which are used to assess the quality of life. The early years of a child's life is considered to be the most important phase of development. For this reason, any interventions to improve the quality of life should be implemented during this stage (Irwin et al, 2007). Caries of the primary dentition, especially in children younger than 5 years, indicates a high caries risk and increases the likelihood that this disease will affect the permanent dentition as well (Tinanoff & Reisine, 2009).

Despite the growing awareness regarding oral health, it is still not a priority in many families and parents often only take their children to the dentist when they experience pain. Untreated dental caries can lead to abscess formation and the resultant pain can influence the ability of children to function optimally in their day to day lives. This can affect their ability to learn due to their inability to concentrate (Kagihara et al, 2009; Moura-Leite et al, 2011) and can cause children to miss school. Changes in behaviour, play and eating patterns as well as sleep disturbances could be indicative of pain due to caries (Gaur & Nayak, 2011; Moura-Leite et al, 2011). In a Brazilian study, the effect that dental pain had on the daily routines of 5-year-old preschool children was investigated (Moura-Leite et al, 2011). It was found that in 72.6% of cases, daily activities were negatively affected, indicating that dental pain significantly impacted on normal functioning, especially with routine tasks like eating, tooth brushing habits and sleeping (Moura-Leite et al, 2011).

Decay of the primary dentition is also one of the main reasons why children are hospitalized (Plutzer & Spencer, 2008). These children usually require extensive dental treatment ranging from restorations and complicated pulpal procedures to the extraction of these teeth in extreme circumstances. As these children are often under the age of 5 years, cooperation is usually poor. This means that more expensive treatment options such as general anaesthesia or sedation (which are also associated with a greater risk of morbidity) have to be considered in most cases (Meurman et al, 2009; Petersen et al, 2005; Tinanoff & Reisine 2009; Kagihara et al, 2009).

Premature tooth loss can lead to the development of malocclusion as teeth do not erupt in the correct position (Menon et al, 2012). Long-term consequences such as speech problems

and loss of chewing function can result and may lead to emotional and psychological after-effects which can ultimately have a negative impact on the quality of life (Plutzer & Spencer, 2008; Tinanoff & Reisine, 2009; Păsăreanu, 2007; Kagihara et al, 2009).

Petersen et al (2005) showed that the cost of managing dental caries has a significant economic impact. It is the fourth most expensive disease to treat. By introducing a preventive programme early in life, the need for restorative treatment can be delayed until children are older and display better cooperation (Pienihäkkinen et al, 2005). This would significantly reduce the demand for general anaesthesia and sedation services and thereby cut costs, especially if one takes into consideration that the health care system is already overburdened.

Drury et al (1999) reported on a workshop attended by paediatric dentists, general dentists and public health experts which was held in April 1999 to review ECC. It was agreed that there was a 'critical lack of information regarding early childhood caries' and that more research was needed in terms of 'epidemiology, etiology and effective prevention in preschool-aged children' (p. 193).

1.2 Definition of Early Childhood Caries

The terminology used to describe this infectious disease process in young children has changed over the years. Terms such as 'baby bottle tooth decay', 'infant caries' and 'nursing bottle mouth' were succeeded by 'baby bottle syndrome' and 'nursing caries'. All these terms have been used to describe this form of rampant decay (Păsăreanu, 2007; Twetman, 2008; AAPD guidelines, 2012-2013a; Kawashita et al, 2011). Ripa (1988) felt that the term 'nursing caries' was a better description of the condition as a bottle is not always necessary to obtain the characteristic clinical picture. It was precisely this reasoning that led to the decision to replace the term 'nursing caries' with 'early childhood caries' as it was thought that it reflected the multifactorial nature of this condition more accurately (AAPD guidelines, 2012-2013a; Brodeur & Galarneau, 2006; Păsăreanu, 2007). Definitions vary according to location of the lesions and the number of teeth affected (Wyne, 1999).

Even though it is far from ideal, early childhood caries has become the more accepted term to describe caries in preschool children (Brodeur & Galarneau, 2006; Drury et al, 1999; Vadiakis, 2008). This definition, along with the abbreviation ECC, is now accepted by global oral health experts. The term ECC itself is open to different interpretations. Begzati et al

(2010) referred to ECC as the 'initial occurrence of caries in the cervical region of at least two maxillary incisors' (p. 2). This is very different to the definition adopted by the American Academy of Pediatric Dentistry (AAPD guidelines, 2012-2013a) which will be elucidated further in Chapter 3.

Severe early childhood caries (s-ECC) is an acute or rampant form of caries which progresses rapidly and includes the terms 'baby bottle tooth decay' and 'nursing caries', the aetiology of which is more specific (Vadiakis, 2008; Brodeur & Galarneau, 2006; Drury et al, 1999).

This lack of consensus over the years, together with the lack of standardization between studies and the use of various terminologies and methodologies, have made it difficult to compare studies and interpret data on this subject matter (Vadiakis, 2008). These definitions and their impact on research will be discussed in more detail in Chapter 3.

1.3 Diagnosis

Due to the differences between the European and American systems in caries detection and inconsistencies in the research criteria for measuring dental caries, there was a need to develop a system to address the concerns regarding the comparability and applicability of epidemiological research (ICDAS II, 2005).

The International Caries Detection and Assessment System or ICDAS-II (ICDAS II, 2005; Ismail et al, 2007; Braga et al, 2009) was thus developed to overcome the lack of consistency among contemporary criteria systems to measure oral and dental problems in epidemiological and clinical studies. An international team of caries researchers constructed the ICDAS criteria to integrate several classification systems into one standard measuring tool for visual classification of caries detection and assessment.

1.4 Characteristics and progression of ECC

Oral and dental diseases vary in their severity and degree of manifestation. Dental caries is a progressive disease that starts with the loss of minerals during the initial stages. The enamel is dissolved by the constant production of acid on the teeth (Kagihara et al, 2009).

The loss of tooth structure leads to the development of microporosities which change the refraction properties of enamel and dentine (Drury et al, 1999). This gives the appearance of chalky white or opaque patches on the tooth surface which can progress towards the final stage of cavity formation (Drury et al, 1999).

The characteristics of s-ECC are very distinct, with lesions predominantly affecting the labial surfaces of the upper incisors and it is associated with 'prolonged and frequent oral exposure to cariogenic substances' (Ripa, 1988; Hallett & O'Rourke, 2006). It is an aggressive process which can progress quite rapidly and usually affects tooth surfaces that are generally not at high risk for developing caries (Vadiakis, 2008; Harris et al, 2004) i.e. smooth surfaces. This condition can start immediately after tooth eruption (Vadiakis, 2008). Teeth are usually affected in the sequence in which they erupt (Kawashita et al, 2011). This means that the four upper anterior teeth are usually the most severely affected as they erupt first (Brodeur & Galarneau, 2006; Kawashita et al, 2011). Teeth that erupt later are affected to a lesser degree (Brodeur & Galarneau, 2006; Kawashita et al, 2011). An initial band of decalcification can progress to cavity formation and at the very worst, total destruction of the tooth, resulting in fracture of the entire tooth crown.

The position of the tongue during feeding (sucking action) protects the mandibular incisors. This, together with the spacing of the mandibular incisors and the proximity of the sublingual and submandibular salivary glands, makes the mandibular incisors less susceptible to caries formation and characteristically, they remain unaffected (Plutzer & Spencer, 2008). Lesions on posterior primary molars appear later (Brodeur & Galarneau, 2006). As the first primary molars erupt ahead of the second molars, they are affected more often (Vadiakis, 2008).

Clinically, the disease can range in severity from a single carious tooth to rampant caries with destruction of the entire dentition (Wyne, 1999). Severely decayed teeth can eventually result in abscess formation and or cellulitis. At this point, emergency dental treatment is needed. As 'severity' of the disease is difficult to 'quantify', how it is documented varies in the literature e.g. Abanto et al (2011) classified the condition as 'high severity' if more than 6 teeth were decayed, missing or filled. This variability makes comparison between studies difficult. For this very reason, Wyne (1999) suggested classifying ECC into 3 types based on severity. Type 1 was classified as 'mild to moderate', type 2 as 'moderate to severe' and type 3 as 'severe' ECC (Wyne 1999). This sub-classification could help to 'determine the seriousness of the ECC problem' and allow for comparison with other populations (Wyne, 1999, p.313).

Begzati et al (2010) also suggested a classification to illustrate the various stages of progression of the disease. Their classification spanned 4 stages starting with the initial stage and followed by the circular and destructive stages. The radix relicta stage was the final, most severe stage and involved total destruction of the crown (Begzati et al, 2010). These suggestions have however not been adopted widely and the most accepted definition is still the definition suggested by Drury et al (1999) and accepted by the American Academy of Pediatric Dentistry (AAPD guidelines, 2012-2013a). This particular definition will be discussed in further detail in Chapter 3.

Throughout the literature, caries patterns vary in description as well as the number and type of tooth surfaces that are involved. There is also no agreement on whether a child can be assigned to more than one caries pattern (Psoter et al, 2004). In order to be able to draw parallels between various studies in terms of ECC prevalence and severity, standardized definitions and descriptions of the various stages of the disease process are essential. This would enable more meaningful conclusions to be drawn between probable risk factors and the development of ECC (Psoter et al, 2004). Until a consensus is reached in terms of definition and description of the disease process, direct comparison between various studies yield very varied results depending on the opinions and outlook of the particular researcher. This issue will be discussed further in Chapter 3.

1.5 Prevalence

Oral health problems have been addressed to some extent throughout the world, yet the progress to reduce the prevalence of ECC has been slow. This is especially evident in the poorer, disadvantaged population groups in developed and developing countries who remain particularly vulnerable to oral disease (Petersen et al, 2005). The prevalence of ECC varies from country to country and the diagnostic criteria that are used to define ECC could also impact on the reported prevalence figures (Begzati et al, 2010).

Brodeur and Galarneau (2006) suggested that by the time children are of kindergarten age, a large number of them are already affected by ECC as the primary dentition is exposed to carious attack from an early age. Pierce et al (2002) stated that in the United States, approximately 40% of children have already been affected by caries by this age.

According to the report of the 1999--2002 National Children's Oral Health Survey which was conducted in South Africa, the prevalence of dental caries in 4-to-5 year-old children in the

Western Cape was 77.1% (Van Wyk et al, 2004). The Western Cape also had the highest caries prevalence across all age groups. From this survey, it was also evident that the primary dentition is more severely affected by dental caries than permanent teeth. The authors therefore suggested that 'prevention of early childhood caries should be an important priority for provinces' (Van Wyk et al, 2004, p. 242). This enormous number of children affected by caries and poor oral hygiene so early in life, also implies huge case loads and has economic implications for future public dental services (Mohamed & Barnes, 2008).

1.6 Treatment need

Data collected from three National Oral Health surveys in South Africa (Van Wyk & Van Wyk, 2010) assessed the trends in dental caries prevalence between 1983 and 2002. It was found that participants in the surveys had large numbers of untreated cavities and that more than 70% of all caries were untreated in children between the ages of 6 and 15 years (Van Wyk & Van Wyk, 2010). Similarly, a large percentage of carious teeth of preschool children in the United States go untreated (Tinanoff & Reisine, 2009).

1.7 Aetiology

Dental caries has a multifactorial aetiology (Twetman, 2008; Păsăreanu, 2007). For caries to develop, a number of factors (which have been shown to be the cornerstone in the aetiology of ECC) need to interact simultaneously (Twetman, 2008; Păsăreanu, 2007; Harris et al, 2004). These include:

- A susceptible tooth/ host
- Oral microflora
- Substrate/ fermentable carbohydrates
- Time

Brodeur and Galarneau (2006) suggest that three factors determine the severity of ECC. These include timing of tooth eruption, length of exposure to harmful oral habits and muscle movements made by the child during feeding. Caries susceptibility can also change over time (Brodeur & Galarneau, 2006).

1.7.1 Susceptible tooth or host

Intrinsic factors such as defects in the enamel composition of tooth structure can lead to hypomineralization and make the tooth more susceptible to bacterial attack (Elfrink et al,

2010; Păsăreanu, 2007; Tinanoff & Reisine, 2009). This is also true of recently erupted teeth with immature enamel (AAPD guidelines, 2012-2013a; Tinanoff & Reisine, 2009). Buffering capacity of saliva also plays a role in caries susceptibility (Păsăreanu, 2007).

Marsh and Devine (2011) reported that there is a 'direct relationship between the properties of the host and activity of the resident microbiota' and that these factors could affect the virulence of these organisms (p. 35). Genetics and defenses of the host also play a role in the composition of the oral microbiota (Marsh & Devine, 2011). Whether the disease manifests or not is dependent upon the balance between the host resistance, virulence of the micro-organisms (i.e. *Streptococcus mutans*) and other environmental factors (Hallett & O'Rourke, 2003).

The type of substrate, frequency of feeding, and lack of oral hygiene are classified as extrinsic factors (Păsăreanu, 2007).

1.7.2 Oral microflora

Caries is an infectious disease which can be transmitted between individuals (Berkowitz, 2006). *Streptococcus mutans* is present in dental plaque and saliva and has been shown to be the main bacterium isolated from children with ECC (AAPD guidelines, 2012-2013b). The presence of these bacteria have been demonstrated in the mouths of infants prior to tooth eruption but it would seem that colonization only takes place once the bacteria are able to attach to hard surfaces i.e. after the teeth have erupted (Berkowitz, 2006).

The presence of *Streptococcus mutans* is increased in individuals with numerous untreated carious lesions. Children of these high caries risk mothers would therefore be more susceptible to contracting the organism than children whose mothers have lower levels of *Streptococcus mutans* in their saliva (Rothe et al, 2010; Berkowitz, 2006). Early colonization of *Streptococcus mutans* through vertical transmission from mother to child due to habits involving salivary transfer has been shown to increase the risk of developing ECC (Meurman et al, 2010; Meurman et al, 2009; Păsăreanu, 2007; Tinanoff & Reisine, 2009; Berkowitz, 2006). For this reason, the American Academy of Pediatric Dentistry recommends that mothers and primary caregivers be targeted (especially during the perinatal period) in order to reduce their mutans streptococci levels, thereby decreasing the risk of transmission of cariogenic bacteria to the child (AAPD guidelines, 2012-2013b and c). Söderling et al (2000) showed that the transmission of *Streptococcus mutans* from mother to child can be reduced

if the mothers regularly use xylitol chewing gum. This subsequently resulted in caries reduction in the children of these mothers.

The caries experience of other members of the household can also impact on the transmission of mutans streptococci. Horizontal transmission of *Streptococcus mutans* can occur between individuals e.g. between family members and playmates at daycare (AAPD guidelines, 2012-2013a; Berkowitz, 2006). This occurs through sharing of utensils or toys contaminated with saliva.

Restoration of carious lesions and introduction of antimicrobial agents such as fluorides and chlorhexidine can reduce *Streptococcus mutans* reservoirs and delay early colonization (Berkowitz, 2006; Kagiha et al, 2009), thereby reducing the risk of a child developing caries (Kagiha et al, 2009). Raising awareness of the infectious nature of caries is also very important in order to reduce transmission of *Streptococcus mutans* (AAPD guideline, 2012-2013a). Caregivers should be advised against sharing utensils and toothbrushes. The importance of oral hygiene practices to reduce the transmission of these organisms should also be emphasized (Berkowitz, 2006).

1.7.3 Mechanical action of bottle- or breastfeeding

The action of sucking reduces salivary flow during sleep (Kawashita et al, 2011; Kagiha et al, 2009). Thus, the cariogenic potential of the bottle contents may also be influenced by the nipple on the bottle. The presence of a nipple causes the lips to become pressed against the teeth, thereby restricting the access of saliva to the teeth and minimizing the 'clearing action' of saliva (Bowen et al, 1997). The use of nursing bottles or "sippy cups" should be discouraged (Kawashita et al, 2011) as dissolution of the enamel takes place more readily where the tips of these vessels come into direct contact with the teeth.

1.8 **Factors playing a role in the development of the disease**

Risk factors predisposing to the development of ECC include behavioural factors, parental attitudes to oral care, the use of pacifiers dipped in sugar, feeding habits and allowing the child to fall asleep while drinking a bottle containing sweetened substances (Vadiakis, 2008; Albert et al, 2002; Twetman, 2008; Losso et al, 2009; Tinanoff & Reisine, 2009). Differences in ethnic, cultural and socio-economic circumstances could also play a role (Tinanoff & Reisine, 2009). Elfrink et al (2010) showed that the country of birth of the mother played a role in the caries experience of their children. Mothers born outside the Netherlands had

children at higher risk for developing caries. The authors however did not specify where these mothers were born and the report was unclear as to how the mother's country of birth actually impacted on the caries experience of their children. They speculated that it could be due to differences in feeding practices (Elfrink et al, 2010) which stem from varying cultural backgrounds. This finding is in agreement with findings of other studies (Reinhardt et al, 2009; Wennhall et al, 2008) where children from immigrant backgrounds were more caries prone.

These factors can be seen as contributing directly or indirectly to caries development. Direct factors include diet, feeding practices, oral hygiene practices and use of fluoride. Other factors such as health of the mother, social circumstances and attitude towards dental care can be seen as indirect.

1.8.1 Direct factors affecting caries development

- 1.8.1.1. Diet
- 1.8.1.2. Feeding practices
- 1.8.1.3. Oral hygiene practices
- 1.8.1.4. Fluoride

1.8.1.1. DIET

It is a well-known fact that unhealthy western diets have resulted in the increased prevalence of overweight children and adolescents worldwide with a resultant increase in the risk of developing heart disease and Type II diabetes mellitus. Dietary patterns are established early in life (most probably by 12 months of age) and are often related to socio-economic status. A child's dietary habits are established by the caregiver (Meurman et al, 2009, Douglass, 2000). Different cultures have different diets and feeding practices and this should be considered when making recommendations.

Dye et al (2010) blamed unhealthy dietary practices for the increase in caries prevalence in their study population. It is a well-known fact that refined diets rich in sugar have been shown to have a detrimental effect on oral health. Frequent snacking is considered a high-risk behaviour for caries development, (Mobley et al, 2009; Peres et al, 2005; Burt & Pai, 2001) especially in patients who are infrequently exposed to fluoride (Burt & Pai, 2001). Increased frequency of sugar consumption leads to increased acid production by cariogenic bacteria and greater severity of the affliction (Tinanoff & Reisine, 2009).

According to Păsăreanu (2007), it is important to educate parents about the implications of frequent sugar intake especially between meals. Incorporation of a reasonable amount of sugar with mealtimes is acceptable and parents are more likely to comply with this suggestion than the total elimination of sugar from the diet.

1.8.1.2. FEEDING PRACTICES

ECC is most commonly the result of night-time feeding where the child is put to sleep with a feeding bottle containing milk, fruit juice or some other sweetened solutions (Chu, 2006). These sweetened substances are broken down by bacteria such as *Streptococcus mutans* which produce acids, thereby initiating cavity formation. Salivary flow is decreased at night which means that the “washing action” of saliva is not as effective. The normal buffering capacity of saliva to neutralize acids in dental plaque is also reduced (Seow, 1998). Thus, poor oral hygiene together with reduced saliva flow, increased metabolism of fermentable carbohydrates and acid production result in the development of ECC.

Sipping on the bottle during the day also increases the caries risk (Hallett & O'Rourke, 2006). “Sippy cups” containing sugared beverages have also been implicated in enhanced enamel demineralization (Kawashita et al, 2011). This prolonged and frequent exposure of teeth to sugar-containing substances, usually beyond 12 months of age (Gussy et al, 2006), is often associated with the development of this characteristic pattern of tooth decay. Extended, on demand breastfeeding has also been implicated in this type of caries pattern (Sowole & Sote, 2006; Yonezu et al, 2006).

a) Bottle-feeding

Bowen and Lawrence (2005) tested the cariogenic potential of substances that are often used in bottle-feeding. These included cola, honey, cow's milk, human milk and sucrose. A desalivated rat model was used because it was thought that it would most accurately mimic the environment occurring in the mouth of a sleeping child who is bottle-fed for prolonged periods and where saliva is virtually absent. The mechanical action of the nipple in the mouth restricts saliva flow, thereby enhancing the cariogenic potential of the bottle contents as well as the solid diet (Bowen & Lawrence, 2005). Of all the substances that were tested, cola and sucrose were the most cariogenic and plain cow's milk was the least cariogenic. Cola and sucrose had a substantial erosive effect leading to severe destruction of the dentition. Honey was also shown to be highly cariogenic and its use is therefore not recommended (Bowen & Lawrence, 2005).

An earlier study conducted by Bowen et al (1997) showed that several infant formulas had 'significant cariogenic potential' (p. 865). Formulas containing sucrose or corn syrup were more cariogenic than those which contained lactose (Bowen et al, 1997). As iron has been shown to have cariostatic properties, it makes sense that formulas low in iron content induced caries formation more readily (Bowen et al, 1997).

b) Breastfeeding

Controversy exists regarding the potential cariogenicity of human breast milk on teeth. Some authors claim that it has the same effect as a bottle if the child is allowed to feed during the course of the night (Păsăreanu, 2007). Matee et al (1992) also reported that 'rampant caries can occur in breast-fed children in the absence of nursing bottles' (p. 186). Prolonged breastfeeding that starts before the primary teeth have erupted fully, has been shown to be a risk factor in the development of ECC (Yonezu et al, 2006; Azevedo et al, 2005). However, a literature search conducted by White (2008) yielded 5 studies, all of which were unable to establish a link between breastfeeding practices and the development of ECC.

Bowen and Lawrence (2005) showed that in comparison to cow's milk, human milk was significantly more cariogenic. This was speculated to be due to the higher lactose content and lower mineral content in human milk (Bowen & Lawrence, 2005). However, when compared with milk formula, it was found that human milk was no more cariogenic (Bowen et al, 1997).

It has been reported that human milk caused a greater drop in plaque pH than bovine milk and was associated with greater loss of enamel (Bowen & Lawrence, 2005). Erickson and Mazhari (1999) found that this drop in pH was not significant when compared with rinsing with water. Where Erickson and Mazhari (1999) concluded that 'human breast milk on its own was not cariogenic' and actually displayed 'protective characteristics' against caries formation (p. 89), Bowen and Lawrence (2005) reported the opposite. They reported that 'human milk clearly has some potential to promote caries development' (p. 925). Due to reduced salivary flow at night, it can be expected that breastfeeding at night would have a more detrimental effect on the teeth (Bowen & Lawrence, 2005).

When interpreting studies on feeding practices, it is also important to acknowledge the role that oral hygiene practices and the rest of the diet could play and how it could influence the way in which the disease manifests. When it comes to breastfeeding, other discrepancies exist in the literature. This will be discussed in Chapter 4.

Controversy also exists regarding the optimal time period for breastfeeding. The American Academy of Pediatric Dentistry recommends that ad libitum breastfeeding should be avoided after the first tooth begins to erupt and other dietary carbohydrates are introduced (AAPD guidelines, 2012-2013c). Contrary to this, other sources cite that breastfeeding should continue as long as desirable (Kramer & Kakuma, 2002; Valaitis et al, 2000), even for as long as '2 years or beyond' (Meyer et al, 2007, p. 271). There is currently no consensus on what the ideal weaning time should be. It should however be borne in mind that the possibility exists that prolonged and frequent nocturnal breastfeeding can pose a risk for the development of ECC (Bowen & Lawrence, 2005) especially in the absence of good preventive measures (Bowen & Lawrence, 2005; Valaitis et al, 2000). Breastfeeding for longer than 1 year could therefore lead to greater susceptibility for ECC development (Valaitis et al, 2000). This issue will be addressed further in Chapter 4.

c) The use of a pacifier

The use of a pacifier (also referred to as a dummy) has been implicated in the development of ECC. However, definitions on what constitutes a pacifier vary in the literature. A search of the literature by Peressini (2003) revealed that pacifier use was inconsistently described. Information regarding duration and frequency of use, whether the pacifier was sweetened or not and the ages of the children in the studies varied, thus hampering comparison. Peressini (2003) concluded that the 'evidence does not suggest a strong or consistent association between pacifier use and ECC' (p. 16). Before recommendations can be made and conclusions drawn regarding the association between pacifier use and the development of ECC, it has been suggested that studies should investigate the use of the pacifier independently i.e. in the absence of other sweetened comforters (Peressini, 2003).

1.8.1.3. ORAL HYGIENE PRACTICES

As visible plaque is a risk factor for the development of ECC (Harris et al, 2004), it stands to reason that plaque removal through tooth brushing practices would play a role in the prevention of dental caries. Parents should be advised to assist their children with tooth brushing on a daily basis, especially in preschool children (Wennhall et al, 2008; Scottish Intercollegiate Guideline Network, 2005). Use of a fluoridated toothpaste should be encouraged twice daily (Scottish Intercollegiate Guideline Network, 2005). The fluoride concentration of these toothpastes should be low (Davies et al, 2002) and the amount of toothpaste on the toothbrush is also important to prevent the development of fluorosis. A 'smear' of toothpaste is advocated for children under two years of age and a 'pea-sized' amount for children between two and five years (Scottish Intercollegiate Guideline Network,

2005). Children should be encouraged to expectorate so that excess toothpaste is not swallowed and rinsing afterwards should also be discouraged so as to maximize the beneficial effects of the fluoride (Scottish Intercollegiate Guideline Network, 2005).

1.8.1.4. FLUORIDE

Despite the overall increase in sugar consumption, caries experience has declined. This is largely attributed to the increased exposure to fluoride. In other words, fluoride exposure has been shown to curtail caries experience and severity in the presence of increased sugar consumption (Burt & Pai, 2001) by counteracting caries formation through neutralizing the effect of sugar in the diet to some extent. Caries experience is therefore not as severe as it would be in the absence of fluoride (Burt & Pai, 2001).

‘Products that release fluoride can be used as preventive and therapeutic approaches’ (AAPD guideline, 2012-2013d, p. 53). In Wennhall’s study (2008), the provision of free fluoride supplements proved to be effective as parental compliance in this regard was excellent. Compliance is essential as a daily commitment is required from the caregiver (Ismail & Hasson, 2008). It is however important to note that there is no real evidence that fluoride supplements prevent caries in primary teeth, especially up to the age of 3 years. Where fluoride-containing toothpastes are regularly used, additional fluoride supplements were shown to be of limited value (Ismail & Hasson, 2008). Davies et al (2002) provided children with free fluoridated toothpaste from the age of 12 months onwards. The children were re-examined at the age of 5 years and it was found that caries levels in these children were significantly lower when compared with the controls.

The systemic effect of fluoride also has disadvantages. An increased occurrence of fluorosis has consistently been associated with the use of fluoride supplements during the first 6 years and especially prior to the age of 3 years (Ismail & Hasson, 2008). When compared to systemic fluoride, topical application of fluoride after tooth eruption has been shown to have a greater protective effect (Kagihara et al 2009). In a study by Elfrink et al (2010), 85% of participants used fluoridated toothpaste. This was the only source of fluoride as the water in the Netherlands is not fluoridated.

Van Wyk and Van Wyk (2010) claimed that the higher caries prevalence in children from the coastal regions of South Africa could be attributed to the negligible fluoride content in the drinking water. Despite this, these authors reported a prevalence of dental fluorosis of more than 20% in their 2004 study. Fluoride levels in the water supply vary throughout South

Africa (Van Wyk & Van Wyk, 2004). Before all water sources in South Africa are fluoridated in an attempt to reduce the caries incidence by making fluoride available to a larger sector of the population, it should be kept in mind that the fluoride content in some water sources exceeds the optimal level thereby increasing the risk for the development of dental fluorosis. These sources therefore need to be defluoridated (Van Wyk & Van Wyk, 2004). Implementation of countrywide water fluoridation would mean that the fluoride content in the water supplies would have to be adjusted for local conditions so that an optimum level is maintained and should be monitored closely.

The reduction in the caries prevalence over the last 20 years has been largely ascribed to the increased use of fluoridated toothpaste (Van Wyk & Van Wyk, 2004). By making fluoridated toothpaste readily available to the general population, there can be more control over the amount of fluoride ingested.

1.8.2 Indirect factors affecting caries development

1.8.2.1. GENERAL HEALTH AND WELL-BEING OF THE MOTHER AND CHILD

There is not much information available regarding the impact of oral health on the general health of children. The consequences of dental caries can lead to more widespread health issues such as diabetes. Children with immune dysfunction could be more susceptible to caries (Peters, 1994; Seow, 1998; Davenport, 1990). Preterm babies have been shown to be more susceptible to health problems and chronic illnesses and generally have poorer oral health when compared with normal, full-term controls (Brogårdh-Roth et al, 2009). Low birth weight, systemic illness, and malnutrition especially during the perinatal period, can result in enamel hypoplasia (AAPD guideline, 2012-2013d; Kawashita et al, 2011). There is a strong correlation between hypoplasia and ECC (AAPD guideline, 2012-2013d). In young children, the host's defense systems are still developing, making teeth more susceptible to carious attack (Harris et al, 2004). The nature and severity of caries patterns can be determined by varying host responses (Vadiakis, 2008).

A study conducted in India by Gaur and Nayak (2011) assessed the effect of s-ECC on growth and quality of life in 100 preschool children. These children came from families in the low socio-economic bracket. It was found that the children's weight and quality of life were negatively influenced by dental caries. After dental treatment, a significant increase in weight was noted. The authors therefore concluded that untreated dental decay may impact on weight and quality of life. The small sample size should however be borne in mind. Even

though 100 children were examined, only 50 children with dental caries were matched with 50 healthy controls (Gaur & Nayak, 2011).

The association between growth and caries was investigated in a study by Kay et al (2010). It was speculated that high cariogenic diets which are low in nutritional content could have an effect on growth (Kay et al, 2010). On the other hand, dental pain, presence of infection and associated loss of appetite in children with ECC may result in them being underweight due to a slower growth rate than in caries-free children. Even though a group of 5-year-olds in South West England who presented with decay showed slower increases in weight from birth to 5 years, a significant association between growth i.e. weight and length at birth, could not been reliably established (Kay et al, 2010).

Alaki et al (2009) found that in children who used systemic antibiotics during the first year of life, the risk for developing ECC was significantly greater than their healthy counterparts. It is speculated that the reason for this could be that in very young children, the teeth are still forming, making them more vulnerable to carious attack (Alaki et al 2009). On the other hand, antibiotics have also shown to suppress certain bacteria like mutans streptococci (Alaki et al 2009). Inferences should therefore be made with caution and other confounding factors such as frequent exposure to sugar-based medications, especially in chronically ill children who need long-term medication, should be taken into consideration. Sugar-free medications should be considered as alternatives in these instances. Parents of chronically-ill children sometimes also exacerbate the problem by consoling them with sugary snacks (Alaki et al, 2009).

Seow et al (2009) identified maternal anxiety as a risk factor for the development of ECC. An association exists between chronic illness and stress but it is unclear whether stress can lead to the development of dental caries (Tinanoff & Reisine, 2009). Parenting stress was however significantly linked to caries experience in a group of 4-to-5-year-old Australian preschool children (Tang et al, 2005). This was confirmed in a study conducted by Menon et al (2012) who found parental stress to be 'one of the best predictors of ECC' (p. 1). They defined stress as 'adjunctive demands' or 'external forces placed on the individual or their internal biological responses' which can lead to 'pathophysiologic consequences' (Menon et al, 2012, p. 1 & 3). Child-rearing practices and the parent's ability to cope emotionally, socially and physically would ultimately have an impact on children's oral health and well-being as children are entirely dependent on their parents to have their basic daily needs met

(Menon et al, 2012). Poor stress management could be responsible for lack of motivation on the parent's part to take care of their children's teeth (Menon et al, 2012).

Children who are difficult and demanding can also add to the stress that parents experience. In order to pacify these children, parents may give in to their demands more readily thereby reinforcing negative behaviour (Menon et al, 2012). This could take the form of consoling them with sweetened snacks or a night-time bottle and/or neglecting the child's oral hygiene. According to Bowen et al (1997), children with sleeping difficulties and short tempers are at higher risk of developing ECC, especially in single-parent homes where putting a child to bed with a bottle is the easiest way to pacify a crying child. Children who were born prematurely also displayed more behavioural problems and this in turn had a direct effect on the quality of oral care that could be provided (Brogårdh-Roth et al, 2009).

1.8.2.2. SOCIOECONOMIC CIRCUMSTANCES AND ETHNICITY

Underprivileged children and/ or those from multicultural or immigrant backgrounds have been shown to have a higher caries prevalence (Reinhardt et al, 2009; Wennhall et al, 2008; Vadiakis, 2008; Kagihara et al, 2009). Hallett and O'Rourke (2006) speculated that this could be due to different cultural and family values which include inappropriate feeding practices.

Poor oral health is directly linked to a lower standard of living (Locker, 2007; Bastos et al, 2008) with caries being more prevalent in poorer families (Brodeur & Galarneau, 2006; Plutzer & Spencer, 2008). Being the recipient of a government grant is also seen as an indicator of poverty (Locker, 2007). Locker (2007) showed that oral health problems had a greater impact on the quality of life of low income families. Wandera et al (2009) also reported that poor general health was associated with a low standard of living and an increased occurrence of dental problems.

Paternal occupation, family structure i.e. whether children came from single-parent or nuclear families, and quality of child-rearing practices were all listed as determinants of socioeconomic status (Sanders & Spencer, 2005). Hallett and O'Rourke (2006) also listed 'language spoken at home' and younger 'maternal age at birth' as strong indicators of socioeconomic status. They found that children with single parents were significantly more prone to develop s-ECC (Hallett & O'Rourke, 2006).

Annual family income and education can be used as predictors of socioeconomic status (Locker, 2007; Meurman et al, 2010; Hallett & O'Rourke, 2006) with children of uneducated

parents having a higher caries prevalence (Tagliaferro et al, 2006; Peres et al, 2005). Low maternal education level was associated with higher colonization of *Streptococcus mutans* in their children (Meurman et al, 2010). Drury (1999) stated that the severity of early childhood caries is likely to be more pronounced in those children from the lower socio-economic groups, especially if their mothers have a low level of education. Unemployed mothers were also a risk factor for increased caries experience in their children (Tagliaferro et al, 2006; Peres et al, 2005). Caries risk amongst individuals from the same social backgrounds can however vary and reasons for this need to be determined.

Psoter et al (2006) showed that as income and the level of the caregiver's education increased, the risk of developing ECC decreased in a group of children aged 5 months to 4 years of age in Arizona, USA. 'Non-white' children i.e. those classified in the study as Native American and Hispanic, also had an increased risk for caries development that was statistically significant (Psoter et al, 2006).

Occupation of the caregiver is regarded as a direct and reliable indicator of socioeconomic status and was shown to have a strong link with caries prevalence in 5-year-olds (Meurman et al, 2010). In two studies by Meurman et al (2009 & 2010), the highest caries prevalence was recorded amongst blue-collar workers i.e. those with a lower level of education or fewer job skills or those who had more menial jobs. Children of these workers showed increased colonization rates by *Streptococcus mutans* (Meurman et al, 2010). A strong association between early colonization of *Streptococcus mutans* and socioeconomic status was demonstrated.

Children from a lower socio-economic group tend to have limited access to dental care (Plutzer & Spencer, 2008) and services are often not affordable (Sanders & Spencer, 2005). Dentists are reluctant to treat children younger than 5 years of age, especially those with high caries levels (Seale & Casamassimo, 2003). This therefore also limits the accessibility of treatment that these children receive. They are more likely to receive treatment at public community health clinics or teaching hospitals which have long waiting lists. This means that, together with the fact that these children are already at an increased risk of developing caries, access to care is delayed, thereby exacerbating the problem by allowing the child's oral health to deteriorate further. The prevalence of toothache is generally also higher in children who come from more disadvantaged and vulnerable backgrounds and they usually require more extensive treatment (Bastos et al, 2008).

Children requiring emergency treatment were shown to be more caries prone (Cariño et al, 2003). Poor access to dental care was cited as one of the possible reasons for the severity of the affliction observed in a study which assessed the utilization of emergency dental and surgical facilities in New York State by children affected by ECC (Nagarkar et al, 2012). It was found that the treatment charges related to severe dental caries increased substantially between 2004 and 2008. The main services provided included treatment of infection through the provision of antibiotics and analgesics as well as restorations and extractions under general anaesthesia (Nagarkar et al, 2012).

Children's oral health has been shown to have a positive correlation with parental care giving behaviour (Păsăreanu, 2007; Drury et al, 1999). Parents who are unable to pay the bills, put food on the table or provide for the health care needs of their families are seen as being highly stressed (Menon et al, 2012). Sanders and Spencer (2005) studied childhood familial conditions and found that family circumstances had an impact on oral health. 'Family circumstance variables' included the degree to which parents were involved with and disciplined their children. Children with ECC are more likely to come from single-parent families (Bastos et al, 2008) who are often overwhelmed with household tasks. This could lead to neglect of the child's oral health as mothers often have to work and are too busy with more pressing issues to pay attention to the details of a child's diet and oral hygiene practices (Menon et al, 2012). Larger families experience similar problems (Bastos et al, 2008) as children do not receive the necessary attention.

Factors such as stress, lack of social support, psychological factors and environmental influences would undoubtedly also have an impact on the development of ECC but these factors and how they contribute to the development of ECC is poorly understood and not well-documented in the literature.

Socio-economic circumstances and environmental influences and stresses vary between different populations and countries. These variables also add to the complexity, making it difficult to compare different studies.

1.8.2.3. ATTITUDE TOWARDS DENTAL CARE

As children are unable to care for themselves, mothers and primary caregivers have to take responsibility for their well-being (Smith & Freeman, 2010). This means that behavioural changes would ideally have to be directed towards the mothers or primary caregivers in order to effect a positive change in the oral health status of these children (Adeniyi et al, 2009; Rothe et al, 2010). Adeniyi et al's study (2009) amongst Nigerian mothers showed that pre-school children whose mothers had a positive attitude towards dental treatment were more likely to have a healthier oral status. Social pressure could also play a role in parental behaviour. Parents who were more concerned about how others viewed them, were more likely to invest in prevention. Their children also displayed fewer carious lesions (Tang et al, 2005). Despite the fact that the majority of disadvantaged children attending urban childcare in Rochester, New York could get free dental treatment and access was not a problem, almost 32% of the children had never been to a dentist. However, 47% of parents interviewed conceded that their children were in need of dental treatment (Kopycka-Kedzierawski & Billings, 2011).

In a South African study, the large numbers of untreated cavities and placement of very few restorations have been ascribed to 'inadequate resources and lack of awareness about oral health' (Van Wyk et al, 2004). This was in agreement with Petersen et al (2005). Many parents have the misconception that primary teeth are going to fall out anyway and will eventually be replaced with a new set of teeth. They therefore see no reason why dental decay in the primary dentition should be a priority and delay seeking treatment for their child's dental needs (Rothe et al, 2010; Menon et al, 2012). Financial stresses might also influence the parent's decision not to seek dental treatment for their child (Rothe et al, 2010). Preventive and restorative services do not seem to be a priority and most health facilities provide only pain relief and emergency dental care (Petersen et al, 2005).

Negative experiences during childhood can have lasting adverse effects which can manifest during adulthood (Sanders & Spencer, 2005). Smith and Freeman (2010) showed that parents who had negative dental experiences during their childhood perpetuate these beliefs and anxiety in their children. Dental visits were usually deferred until a problem arose as parents did not want to expose their children to the "unpleasant dental treatment" they experienced as children. The caregiver's attitude towards dental treatment would therefore have a direct impact on the child's oral health. Changing parental attitudes to dental health is therefore essential to improving the oral health of their children.

1.9 References

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CHAPTER 2

AIMS OF THE STUDY

2.1 Background

The lack of detailed data on the extent of dental caries among the low income groups in Cape Town resulted in a low priority being given to this problem by the health services. Results obtained from a pilot study (Mohamed & Barnes, 2008) have demonstrated that there is a definite need for reliable data highlighting the nature of the problem in order to initiate remedial programmes. The parents of vulnerable children especially those under six years of age from disadvantaged communities, need to be informed about the importance of oral health and the prevention of oral disease. Another important group of role players is the first-line health service providers who could assist in addressing this widespread public health problem by intervening in cases where children have been affected. These staff members working at community health clinics can become valuable allies in combating early childhood caries in South Africa.

2.2 Overall aim of the project

To investigate the extent of early childhood caries in a population of children from lower socio-economic areas in the drainage area surrounding the Tygerberg Oral Health Centre who utilize health services in that area, the knowledge of their caregivers regarding the problem as well as the knowledge of the primary health care workers dealing with these children.

This project was divided into three sub-studies. All sub-studies were approved by the Research Committee of the Faculty of Health Sciences of the University of Stellenbosch.

2.3 Sub-study 1: Prevalence study (Chapter 3) - Main thrust of the investigation

2.3.1 Objectives for Sub-study 1

1. To assess the prevalence of oral and dental problems, especially early childhood caries, in children under six years of age in the study population residing in the area.
2. To assess the major demographic characteristics of the children with early childhood caries.

This sub-study assembled a large population of children from the study area and used descriptive statistics to estimate the true prevalence of ECC among them. No hypothesis was set as this does not form part of the conceptual framework of cross-sectional designs. The major variables were the various aspects of ECC noted in the participants as well as the demographic profile of the children found to be suffering from ECC.

2.4 Sub-study 2: Survey of attitudes, knowledge and habitual caregiver behaviour impacting on their children's oral health (Chapter 4) - supporting study

2.4.1 Objectives for Sub-study 2

As many parents or caregivers of the children participating in sub-study 1 as could be found were interviewed by means of a structured interview (Appendix C) in order to:

1. Investigate their knowledge and practices regarding general oral health in their children.
2. Investigate the factors (behavioural, social and environmental) associated with signs and symptoms of early childhood caries in their children.
3. Gain insight into the practices and knowledge of these caregivers regarding early childhood caries in these children.

2.5 Sub-study 3: The management of early childhood caries in the primary health care system (Chapter 5) - supporting study

2.5.1 Objectives for Sub-study 3

1. To gain insight into the knowledge of primary health care professionals outside dentistry (delivering care to the children in the study) regarding oral health in children and specifically early childhood caries and its causes.

2. To determine the sources of the knowledge and current practices displayed by non-dental primary health care professionals (nursing staff) regarding oral health.
3. To determine the frequency of routine oral examinations carried out by these professionals and the circumstances under which they are performed.
4. To ascertain whether information regarding oral health is routinely disseminated and the factors which play a role in the type and quality of information being disseminated.

2.6 Ethical considerations

This study was approved by the Research and Ethics Committee of the Faculty of Health Sciences of the University of Stellenbosch. The sub-projects were registered under numbers NO7/10/225, NO7/10/223 and NO7/10/224.

Consent was obtained from the Provincial Department of Health and City Health (City of Cape Town) to conduct the study at various community clinics. Permission was also sought from the Tygerberg Hospital administration for the second leg of data collection from health care workers. After the Provincial Department of Health permission was granted this was conveyed to the principal of each school to obtain permission to carry out the study. Permission from City Health (City of Cape Town) was conveyed to the superintendent of each community health facility where children were examined in order to obtain permission for the study to be carried out there as well.

Written informed consent was obtained from the parents of the children that were examined as well as the health care professionals included in the study (Appendix B). There are three major languages of communication in the study area, namely English, Afrikaans and to a lesser extent, isiXhosa. As the candidate is not able to speak isiXhosa, an isiXhosa consent form was prepared for Xhosa-speaking parents or caregivers to inform them about the study. This was however not used as all parents interviewed could speak English and/ or Afrikaans. An information leaflet about the study was handed to each participant (Appendix B).

Objectives were achieved by making use of a data capture sheet (Appendix A) to record each child's caries status. The children were examined in the waiting rooms in the presence of their caregivers and no special facilities were needed for this purpose. Interviews with the caregivers were also conducted here. Questionnaires were distributed to the health care workers i.e. nursing staff and the completed forms were collected at a later date. There was thus no interruption to the normal working schedule at any of the facilities.

Anonymity was strictly observed in this study. No names or identities were asked or recorded and the caregivers were shown the completed data sheets without any identification on them to assure them that anonymity was duly preserved. The consent forms (containing signatures) were posted into a separate sealed container that was only opened at the end of the study so that no consent form could be matched with its accompanying data capture sheet.

2.7 Design of the research strategy of the study

Health survey methodology is a 'widely used research approach in public health and epidemiological health studies' (Timmreck, 2002; Bless & Higson-Smith, 1995; Neuman, 1997). The construction of the aims and objectives, sampling strategy and analysis of data in this study were designed to comply with generally accepted principles of survey methodology. The research strategy was a cross-sectional survey concentrating on quantitative elements gathered by means of formal clinical investigations, but also incorporating a few qualitative features as a means of explaining the quantitative variables. The qualitative elements were gathered by the candidate herself by means of structured interviews.

A major strength of cross-sectional studies is that it is appropriate for the determination of the extent or the size of problems on a community level (Bless & Higson-Smith, 1995; Neuman, 1997; Katzenellenbogen et al, 1999). All the objectives of the present study were aimed at assessing the extent to which early childhood caries with its attendant problems were present in the population studied as well as its underlying associations with lifestyle choices and their impact.

2.7.1 Sampling strategy

2.7.1.1. SAMPLE SITES

In keeping with the approach utilised in survey methodology, the sample sites were selected to provide as representative a group of participants (children) as possible. The municipal officials in charge of the indigent policy applications in this part of the City of Cape Town were approached and they identified the areas where the largest number of persons either did not pay any municipal rates and taxes or where they received the indigent benefits made available by the City.

It was decided to survey the children accompanying adults to the various health care service points but who did not suffer from any health condition needing attention at the time. Children accompanying adults is a common practice in this area as child care facilities or casual supervision over children left alone at home is a big problem. This provided the opportunity to examine the children in a health care setting and to provide a link with the health care staff at the facility. In order to avoid any bias in the composition of the study group (in case the children accompanying adults to the clinics were somehow different to those who went along to other places), a group of children from preschools/crèches in the area were also included. Unfortunately the parents of these children were not easily accessible and therefore their information could not be captured, thus the number of parental interviews are lower than the number of children in the prevalence study. The preschools and crèches were all government-funded except one, and served the same impoverished population in the study area. The only private preschool in the study had children from a slightly higher income bracket but those children also came from the same low-income urban areas identified by the municipal officials. All these preschools were truly disadvantaged with very few facilities and resources.

Some of the health care facilities approached did not want to participate. Thus it was decided that since the number of health care workers in the primary health care clinics obtained would be inadequate, the nurses in Tygerberg Hospital who work in the paediatric intake wards and who deliver primary health care services similar to those in the clinics would also be approached. Tygerberg Hospital is officially classified as a tertiary health care centre, but historically the hospital has provided primary health care services to the surrounding community for many years and still does so. Before the rural platforms for training of medical students and allied health disciplines were developed, this facility was an important primary health care exposure for students. This role is continuing, albeit on a reduced scale. Permission was therefore also obtained from the administrative office of the Tygerberg Hospital to include nurses who work in the paediatric intake wards and come into contact with children potentially suffering from early childhood caries.

2.7.1.2. SAMPLE SIZES

No *a priori* comparative hypotheses were constructed (that is not the approach employed in community surveys and cannot be supported by such a study design) and therefore no formal calculations of minimum sample sizes can be carried out as is the case for inferential statistics where the usual requirements of sufficient accuracy and statistical power are demanded. The goals in survey methodology are first and foremost to obtain a sufficiently

representative and unbiased sample to provide reliable findings and secondly, to obtain information from a large enough number of sampling units to permit fair inclusion of the less common instances (i.e. 'exceptions') of the variables under investigation. In this study, sampling was approached in the same way as employed in empirical research to utilize the largest possible but realistic sample size, given the constraints of time and money (Bless & Hinson-Smith, 1995). Sampling in such study designs intends to obtain as true a picture of the conditions to be studied as possible without the necessity of obtaining data from an entire population, for reasons of practicality and cost-effectiveness (Bless & Hinson-Smith, 1995; Neuman, 1997; Katzenellenbogen et al, 1999).

In a survey there is no intention to construct certain groups meeting inclusion and exclusion criteria on a group basis such as employed in designs to test hypotheses by means of statistical inference. The only inclusion and exclusion criteria employed in the study were designed to ensure that only children included in the age group susceptible to possible ECC under the international definitions of ECC were accepted into the database of the study itself, even though some older children were also examined at the request of caregivers or parents. That is why the distribution of e.g. ages and genders in the survey data are not neatly equal or in any way predictable. The survey simply registers the situation encountered at the time of the data gathering.

There are sample size calculations for surveys designed to provide the data from which statistical estimates can be inferred with predetermined accuracy and confidence intervals, especially surveys for the prediction of national and household censuses (Bless & Hinson-Smith, 1995; Neuman, 1997; United Nations Department of Economic and Social Affairs, 2005). There are however no sample size calculations available to determine optimal sample sizes for *once-off cross-sectional surveys* providing information on the existence and extent of characteristics such as health-related conditions or sanitation status.

2.7.2 Research Tools

The use of questionnaires is an indispensable tool in community health research (Bless & Hinson-Smith, 1995; Neuman, 1997; Valanis, 1992). Findings in community health studies are often based partly or completely on data obtained by means of questionnaires or structured interviews (so-called 'verbal questionnaires') with data captured on data capture forms (please refer to Appendices A and D). Information on outcomes, exposures and confounding variables are collected in this way (Neuman, 1997; International Epidemiological Association European Group). Please note that the caries risk category (question number 3)

in Appendix C was not recorded in the actual survey as there were too many variables which needed to be taken into consideration and noted during the interview. No subject or participant was assessed for this category.

The following tools were used in the survey:

Questionnaires were drawn up from information gathered during the pilot study prior to registration for this doctoral study (Mohamed & Barnes, 2008) and designed in collaboration with the chief study supervisor who teaches questionnaire design as part of her academic duties and holds a PhD in Community Health. The questionnaires were piloted among children and caregivers meeting the study inclusion criteria and no ambiguity, misunderstandings or other problems were encountered among the participants. The candidate is a qualified dentist with a Masters' degree in Paediatric Dentistry. She is responsible for the clinical treatment of all children with ECC in the Tygerberg Oral Health Centre and has 15 years of experience in this clinical field.

This was a cross-sectional study done strictly anonymously as required by the Ethical Committee of the Faculty of Medicine and Health Sciences. No participant identification could be retained for follow-up purposes. It was therefore not possible to do repeat examinations to determine intra-examiner reliability. Such reliability scores are not usually calculated for once-off surveys. Note that only the presence or absence of caries was recorded and that the decision involved very little ambiguity that an experienced paediatric dentist could not immediately resolve.

2.8 Conceptual framework of study and links to objectives

The study presented in this dissertation focuses on ECC by means of three inter-related aspects. The first and prime objective was to ascertain the extent of the problem by determining the prevalence in the study area. The second and supporting aspect was to assess the knowledge, attitudes and contributing practices of the main caregivers of the children in sub-study 1 (prevalence study). The second supporting study assessed the knowledge, attitudes and practices regarding ECC among a sample of health care givers working in primary health care facilities in the study area.

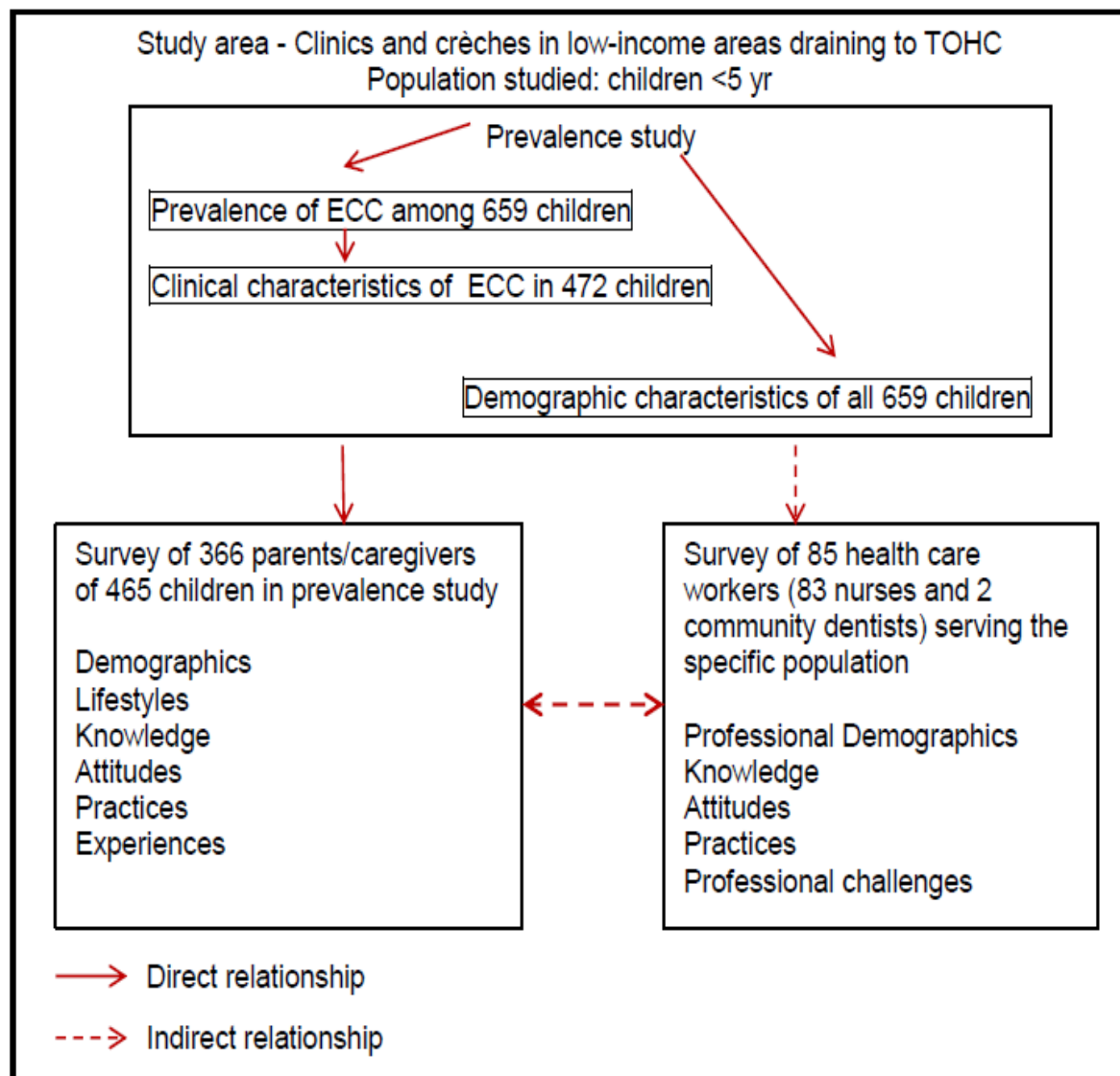


Fig 2.8.1: Conceptual framework of prevalence of ECC as it relates to parental factors and health services in the study area.

2.9 Statistical considerations

Data were captured into a Microsoft Excel spreadsheet and transferred by a statistician at the Centre for Statistical Analysis at the University of Stellenbosch into Statistica version 11 (StatSoft Inc. 2012, USA) for further analysis. Data capture was monitored by taking random samples of records and checking the data entry. No mistakes were found. Data integrity was monitored by the study supervisors and the statistician during the analysis and reporting of the data.

The data was analysed by Prof M Kidd, Head of the Centre for Statistical Services at the University of Stellenbosch. The data was cross tabulated and Chi-squared analysis was carried out as first order non-parametrical analysis.

Logistic regression has been used to predict whether a child has ECC, based on the observed characteristics of the child (age, gender, etc.) and to predict the odds of having ECC based on the values of the independent predictor variables. The odds in this case are defined as the probability that a particular outcome is a case of ECC divided by the probability that it is a non-case (i.e. healthy dental condition). Since this is an analysis incorporating all three major sub-themes (child ECC and demographics, parental aspects and aspects of health care workers) simultaneously, the results of this analysis are represented in a short separate chapter (Chapter 6).

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CHAPTER 3

SUB-STUDY ON THE PREVALENCE OF EARLY CHILDHOOD CARIES IN THE LOWER SOCIO-ECONOMIC AREAS SURROUNDING TYGERBERG ORAL HEALTH CENTRE

3.1 Introduction

For the most part, childhood dental caries is a preventable disease (AAPD guideline, 2012-2013a; Vargas & Ronzio, 2006). Yet, it is a problem which still affects a large percentage of children worldwide in developed and developing countries (Ferreira et al, 2007; Wennhall et al, 2008; Plutzer & Spencer, 2008; Dye et al, 2010; Kumarihamy et al, 2011).

The economically disadvantaged population groups in developed and developing countries remain particularly vulnerable to oral disease (Petersen et al, 2005; Hallett & O' Rourke, 2002). Underprivileged children and/ or those from multicultural or immigrant backgrounds have been shown to have a higher caries prevalence (Reinhardt et al, 2009; Wennhall et al, 2008; Dogar et al, 2011).

Even though caries in itself is not life-threatening, the extent of this oral health problem is of major significance as it ultimately has an impact on general health and well-being and affects the quality of life. Poor oral health can result in poor general health and have a definite impact on an individual's quality of life (Petersen et al, 2005). Dental caries in young children can result in pain and infection which requires invasive dental treatment, often under general anaesthesia. Furthermore, dental problems in early childhood have been shown to be predictors of future dental problems including orthodontic problems caused by early loss of teeth (Canseco et al, 2011). It can also impact on growth and cognitive development and can lead to problems with nutrition, concentration and the ability to function optimally at school (Gussy et al, 2006; Kumarihamy et al, 2011).

Dental caries places a huge burden on existing resources. By emphasizing prevention and by reducing the prevalence of ECC, the need for more expensive treatment options such as general anaesthesia and sedation services can be alleviated.

The Tygerberg Oral Health Centre (TOHC) is the only public oral health hospital in the entire metropolitan area of the City of Cape Town. A retrospective, records-based study (Mohamed & Barnes, 2008) provided a good reflection of the cases needing treatment under general anaesthesia in this area. These observations however needed confirmation in a community-based survey which included children who were not sampled on any oral health care service premises. Only children presenting at the TOHC for treatment were included in this study while it was unknown how many children in the community at large were affected. Thus, an accurate prevalence could not be predicted on the basis of this retrospective study since the population size from which the affected children originated could not be reliably predicted.

3.1.1 Issues in reviewing the prevalence of ECC

The term “prevalence” is used in much of the dental research literature to denote the percentage of persons affected out of a study group. The term “prevalence rate” is used to denote the total number of cases in a designated population over a specified time period (usually one year). In this dissertation, these two terms are used with the aforementioned meanings.

It is often not possible to draw direct comparisons between different articles due to varying methodologies. The lack of standardization for definitions, sampling procedures, diagnosis and age groups targeted, hampers comparison.

The confusion regarding disease definitions and varying inclusion and exclusion criteria have serious implications for reviewing the prevalence of ECC as reported in the research literature. For instance, Vargas and Ronzio (2006) remarked that the prevalence of ECC in most United States studies does not include non-cavitated or white spot lesions. The true prevalence of ECC can therefore be expected to be well above the published estimates (Vargas & Ronzio, 2006).

In the literature, a wide variety of case definitions and diagnostic criteria have been used to describe ECC and s-ECC in young children (Ismail & Sohn, 1999). Earlier terms referring to s-ECC include nursing caries, baby bottle tooth decay, labial caries and rampant caries (Ismail & Sohn, 1999). Some studies have defined ECC in very broad terms such as ‘dental

caries in preschool children' (Ismail & Sohn, 1999, p. 171) or 'children presenting with at least one decayed or extracted tooth' (Ferreira et al, 2007, p. 290). Begzati et al (2010) defined ECC as the 'initial occurrence of caries in the cervical region of at least two maxillary incisors' (p. 2). A similar definition was used by Dogar et al (2011) who classified s-ECC as 'the carious involvement of two or more upper front (maxillary anterior) teeth' (p. 2).

In order to facilitate comparison between studies, Drury et al (1999) proposed that more specific standardized definitions for ECC and s-ECC be used. The American Academy of Pediatric Dentistry modified these definitions that were originally defined by the National Institute for Dental and Craniofacial Research (Drury et al, 1999). These definitions are now universally accepted.

ECC is defined as 'the presence of one or more decayed (non-cavitated/ cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger' (AAPD guideline, 2008; AAPD guideline, 2012-2013b, p. 50). Selected decay or extractions of posterior teeth is included in this definition.

S-ECC refers to any carious lesion of the smooth surfaces, especially of the maxillary anterior teeth, in children younger than 3 years of age. Between the ages of 3 and 5 years, the definition of s-ECC also includes one or more cavitated lesions, extractions or restorations of the maxillary anterior teeth (AAPD guideline, 2008; AAPD guideline, 2012-2013b). A dmft (i.e. decayed, missing, filled teeth) index of ≥ 4 at 3 years, ≥ 5 at 4 years or ≥ 6 at 5 years of age also constitutes s-ECC (AAPD guideline, 2008). This term describes a more rampant form of decay and is typically associated with infant feeding practices (Ismail & Sohn, 1999).

ECC and s-ECC can occur in the same mouth at the same time and are therefore not mutually exclusive. The position of the caries distinguishes the one caries distribution pattern from the other where s-ECC characteristically involves the maxillary anterior teeth. Caries of posterior teeth develop later and can be due to factors other than infant feeding practices (Sayegh et al, 2002).

Various diagnostic criteria have been used to record caries. Among these, the use of the following systems have been reported in the literature: WHO dmft index (Lawrence et al, 2009), British Association for the Study of Community Dentistry/ BASCD standardization

criteria (Hallett & O' Rourke, 2002), International Caries Detection and Assessment System/ ICDAS (Finlayson et al, 2007) and, the Nyvad scoring system (Braga et al, 2009).

The WHO dmft index is by far the most widely used criteria (Lawrence et al, 2009; Begzati et al, 2010; Canseco et al, 2011; Livny et al, 2007; Dogar et al, 2011). It is a crude system that simply records the presence of decayed teeth (d), teeth that have been extracted/ missing (m) and teeth that have been restored/ filled (f). The disadvantage of this system is that non-cavitated or initial lesions are not recorded (Braga et al, 2009; Livny et al, 2007) and subjects could be recorded as 'caries-free' even if these early lesions are present.

The BASCD standardization criteria is similar to the WHO criteria except that it is more specific. Besides the normal decayed, missing and filled teeth as noted with the WHO criteria, specifics of the filled surfaces, pulpal involvement, arrested caries and presence of plaque are also recorded. A negative of the BASCD criteria is the statement that 'all questionable lesions should be recorded as sound' which once again means that early carious lesions could go unrecorded (NHS National Policy, 2007/ 2008, p. 13).

ICDAS-II (ICDAS II Criteria Manual, 2009; Ismail et al, 2007; Braga et al, 2009) is a visual index for caries diagnosis. An international team of caries researchers constructed the ICDAS criteria to integrate several classification systems into one standard measuring tool which would overcome the problem of overlooking initial lesions. ICDAS was expanded to include Lesion Activity Assessment i.e. ICDAS-LAA (ICDAS II Criteria Manual, 2009) which took aetiological factors into consideration and made it possible to distinguish between teeth requiring preventive or restorative measures. It was thus possible to distinguish between active and inactive lesions. ICDAS was largely based on the Nyvad scoring system (Braga et al, 2009) where the major difference between the two systems was that ICDAS assesses lesions after plaque has been removed. Different instruments were also used to diagnose caries. With both systems, changes in lesion colour and presence of plaque and texture of the lesion were recorded. These systems thus made use of visual and tactile methods to diagnose caries. Even though visual scoring of caries is subjective, the ICDAS criteria have proven to be a reliable and valid method for detecting caries (Ekstrand et al, 2007). It has also shown reliability comparable to the WHO criteria (Braga et al, 2009) and unlike the dmft system, ICDAS allows for the measuring of caries from the earliest stages of demineralization (Finlayson et al, 2007; Diniz et al, 2009).

Both visual and tactile methods have either been used separately (Ferreira et al, 2007; Peressini et al, 2004) or in combination (Lawrence et al, 2009; Sayegh et al. 2002). Studies that make use of tactile methods may be able to detect lesions that are not visible to the naked eye. It is therefore very likely that a greater number of carious lesions are recorded using the tactile method, inflating the number of affected cases reported. Ferreira et al (2007) and Livny et al (2007) made use of purely visual means of caries identification in their study. This method also included what was called the “lift the lip” technique (Livny et al, 2007). A study by Kopycka-Kedzirawski and Billings (2011) assessed the effectiveness of a purely visual examination called teledentistry examinations. Here, an intraoral camera was used to record images of the oral hard tissues. It was found that this method was comparable to the tactile/ visual method of caries detection in terms of caries severity and caries prevalence (Kopycka-Kedzirawski & Billings, 2011).

Some standardized criteria have been changed or adapted e.g. Thitasomakul et al (2006) adapted the WHO criteria. Other studies such as the one by Peressini et al (2004), did not mention a specific scoring system for recording caries and Begzati et al (2010) proposed their own criteria for recording the progression of the carious process. They identified 4 stages starting with the initial stage or white spot lesion and ending with total destruction of the crown (Begzati et al, 2010).

Variations in the actual dental examinations also exist, e.g. in some studies the tooth was dried or cleaned prior to examination (Hallett & O'Rourke, 2002; Ferreira et al, 2007; Kumarihamy et al, 2011) where other studies do not report the methods in so much detail (Peressini et al, 2004; Canseco et al, 2011; Tyagi, 2009). Some studies had only one examiner conducting the dental examinations (Peressini et al, 2004) and others made use of numerous individuals to record the data (Thitasomakul et al, 2006; Hallett & O'Rourke, 2002; Lawrence et al, 2009). In the latter instance, calibration of examiners to minimize inter-examiner variability is important (Thitasomakul et al, 2006; Hallett & O'Rourke, 2002; Lawrence et al, 2009).

ECC is not evenly distributed across population groups and geographical regions. There is overwhelming evidence that ECC is more prevalent among children from low-income or minority group families (Vargas & Ronzio, 2006; Hallett & O'Rourke, 2006; Reinhardt et al, 2009; Wennhall et al, 2008; Shiboski et al, 2003; Psoter et al, 2006; Schroth et al, 2010; Canseco et al, 2011). Moreover, children from low-income families are also more likely to present with a more severe form of disease (Brodeur & Galarneau, 2006; Bastos et al, 2008;

Finlayson et al, 2007; Ferreira et al, 2007; Albert et al, 2002). For this reason, discussing the various prevalence levels reported in the literature should always include an indication of the socio-economic status of the participants in the study wherever such information was provided. This information is a necessary part of the sample description but it is sometimes neglected. One should be cognizant of the fact that differences exist between low socio-economic groups from different parts of the world and environmental and social factors specific to each community such as fluoridation of the water supply could also impact on the caries experience (Thitasomakul et al, 2006; Ferreira et al, 2007) e.g. the low fluoride concentration in the drinking water was thought to contribute to the high caries prevalence reported by Thitasomakul et al (2006).

ECC can start at a young age and the lesions progressively get worse as the child gets older (Ferreira et al, 2007; Brodeur & Galarneau, 2006; Maro & Kahabuka, 2007; Cariño et al, 2003; Hallett & O'Rourke, 2002). For this reason, care should be taken when comparing data from different age groups.

A study in the northern Philippines found that caries was present in 59% of two-year olds, 85% at three years of age and by five years of age, 94% of the 993 children surveyed were already affected (Cariño et al, 2003). This "cumulative" nature of ECC therefore makes it imperative for all studies to report the age groups reported in the data. It however still remains a challenge to compare prevalences from reports that do not distinguish between the various age categories but only report on the prevalences for groups as a whole. This is illustrated in studies such as those conducted by Ferreira et al (2007) and Thitasomakul et al (2006). Ferreira et al (2007) reported a caries prevalence of 40% in children between the ages of 0 to 5 years. Thitasomakul et al (2006) reported on smaller categories. In the latter study, prevalence figures ranging from 2% in 9-month-olds to 68.1% among children 18 months of age were reported. It is clear that the reporting of data varies from study to study. It is thus very difficult to compare these results and draw meaningful comparisons.

The above-mentioned limitations should be borne in mind and drawing comparisons between studies should therefore be done with caution.

3.1.2 General prevalence trends

Despite the fact that oral health problems have been addressed to some extent, the progress to reduce the prevalence of ECC has been slow. Throughout the literature, prevalence rates for ECC have varied considerably between different countries and population groups.

The prevalence of ECC is influenced by a number of factors. Parental care-giving behaviour (especially regarding oral hygiene and feeding practices), socio-economic determinants, parental education and differences in lifestyle and culture, can all contribute to the development of ECC (Petersen et al, 2005; Finlayson et al, 2007; Jerkovic et al, 2009).

Developing countries like India and Sri Lanka are expected to have a high caries prevalence due to the poor socio-economic status of the majority of their populations. Prevalence figures of 36.42% amongst 3-to-5-year-olds in Bhopal, India and 32.19% in the 1-to-2-year age group in Sri Lankan children have been reported (Tyagi, 2009; Kumarihamy et al, 2011). Two other studies conducted in India attest to the variations in caries prevalence within different parts of the same country (Priyadarshini et al, 2011; Viridi et al, 2010). In preschool children aged 24 to 59 months residing in the poorer areas of Bangalore city, India, ECC and s-ECC prevalence was reported to be 37.3% and 94.3% respectively (Priyadarshini et al, 2011). A much lower prevalence of s-ECC (42.03%) was reported amongst a group of children from Bahadurgarh, Haryana between the ages of 1 and 5 years (Viridi et al, 2010). However, in the latter study, no mention is made of the socio-economic status of the sample and the age groups reported on in the two studies differ.

In a Brazilian study conducted amongst children between the ages of 0 to 5 years from government nurseries situated in low socioeconomic areas, the overall caries prevalence was reported to be 40% (Ferreira et al, 2007). Other studies report the caries prevalence amongst Japanese 3-year-olds in 2006 to range between 14.3% to 71.1% across various socio-economic groups and municipalities (Aida et al, 2006) and in Quchan, North-east Iran, an 82% prevalence of ECC was recorded amongst children from the lower socio-economic areas between the ages of 6 months and 5 years. S-ECC prevalence in this group of children was recorded at 42.7% (Mazhari et al, 2007).

The literature is also unclear as to what constitutes “high caries prevalence”. A study was conducted in Kosovo on a random sample representing 80% of all kindergarten children aged 1 to 6 years (Begzati et al, 2010). No mention was made of the socio-economic status of these children. This study reported a ‘serious public health problem’ with a reported ECC prevalence of 17.4% (Begzati et al, 2010, p. 4). Yet, this is far lower than many other studies in the literature. The authors felt that the “deplorable state” of oral health could be blamed on the lack of preventive programmes and an inefficient health care system. When compared to the lower caries prevalence in developed countries like the USA that possibly have more

programmes in place to counter the problem, the authors felt that a prevalence of 17.4% was “high” (Begzati et al, 2010).

Despite the fact that the Jahalin Bedouin community on the outskirts of Jerusalem is considered to be a severely deprived nomadic community that lacks basic facilities, a prevalence of only 17.6% was reported in 1-to-3-year-old children. In this case however, the authors reported this prevalence to be “not very high but neither low” (Livny et al, 2007).

Higher caries prevalence rates have been recorded amongst minority populations. Studies among off-reserve 3-to-5-year-old Aboriginal children in Ontario, Canada have revealed a prevalence of ECC ranging from 74% to 82% while non-Aboriginal children showed an ECC prevalence of 31% to 35% (Lawrence et al, 2009). These differences were speculated to be due to unspecified cultural differences or possible reduced access to dental care for Aboriginal families not living on the reserve (Lawrence et al, 2009). Three and 5-year-old children in the district of Manitoulin, Ontario, Canada showed an ECC prevalence of 52% (Peressini et al, 2004). Another study in Manitoba, Canada revealed a prevalence of 53% amongst Hutterite preschool children younger than 6 years. Approximately 42% of these children were diagnosed as having s-ECC (Schroth et al, 2010).

Caries prevalence was assessed amongst minority groups in the low socio-economic areas of Rochester, New York (Kopycka-Kedzierawski & Billings, 2011). Participants consisted mostly of African-American and Hispanic children between the ages of 1 and 5 years attending urban childcare. Even though these children were considered to be “deprived”, caries prevalence was recorded at 28 % (Kopycka-Kedzierawski & Billings, 2011).

In the remote rural areas of Western Australia, 2-to-4-year-old preschool children displayed varying degrees of tooth decay (Dogar et al, 2011) with the overall group showing 39% prevalence of tooth decay. The children belonging to the indigenous group showed a 70% prevalence of caries, while the children belonging to the non-indigenous portion of the population showed a 25% prevalence of caries. S-ECC was recorded in 19% of all the children examined. This figure soared to 34% amongst the indigenous children alone. Indigenous children were therefore more severely affected overall (Dogar et al, 2011).

Caries prevalence in a study of 4-to-6-year-old children from all socio-economic levels conducted in North Brisbane, Australia was reported to be 33.7% (Hallett & O'Rourke, 2002). This overall prevalence, however, varied from 22.3% to 47.5% for children from various living

“zones” in the study area of the city, corresponding to varying socio-economic levels. Caries prevalence of the 4- and 5-year-old children was 30.7% and 34.8% respectively. This is low when compared to a country like Jordan where the overall prevalence varied from 61.7% in the 4-year-old participants to 72.5% in the 5-year-olds (Sayegh et al, 2002). No information on socioeconomic background for the latter study was provided (Sayegh et al, 2002).

In South Africa, a National Oral Health Survey was conducted on 4-to-5-year-old children from all socioeconomic strata and race groups between 1999 and 2002 (Van Wyk et al, 2004). The participants of this survey were examined at crèches, day care centres and grade nought classes of primary schools. No children outside the formal school system were included. Nationally, the overall caries prevalence of children in this age group was 51%. The Western Cape, (the province in which the present study is also located) had the highest caries prevalence across all age groups of all the provinces included in the survey. In this survey, it was reported that the primary dentition was more severely affected by dental caries than permanent teeth.

Besides this survey, there is practically no other data for caries prevalence in the South African population. In a 2008 publication, Postma et al used this same dataset to report on the prevalence and severity of ECC.

3.1.3 The current situation

The growing waiting lists for sedation and general anaesthesia at the TOHC tend to indicate that the high caries prevalence seems to have reached significant proportions in this sector of the population. A previous retrospective study among children under the age of 6 years found that extensive caries of the primary dentition occurs in children of this age category in the drainage area of Tygerberg hospital (Mohamed & Barnes, 2008). This lends further support to the need for a new approach to alleviate the problem.

A true prevalence study of early childhood caries in any area requires both the ascertainment of all the cases of ECC and a detailed database of the population in the appropriate age group in the same area. This information is not available at district level for most areas in South Africa. To complicate matters, the presently available official South African census data is out of date for present needs and also contains a differential but fairly large under-count, especially in certain communities. A new census has been undertaken, but the results at community level are not expected for some time yet.

The true extent of the problem of ECC in the disadvantaged portion of the community served by the TOHC is unknown at present. It is also not known which age groups are most affected. This information is crucial in order to plan and execute remedial measures.

3.2 Aim of the sub-study

1. To assess the prevalence of oral and dental problems, especially early childhood caries, in children under six years of age in the study population residing in the area.
2. To assess the major demographic characteristics of the children with early childhood caries.

3.3 Methods

An oral health survey of children from various lower socio-economic areas draining to the Tygerberg Oral Health Centre was conducted. For the purposes of the present study, 'low socio-economic areas' were seen as those areas where the City Council has an indigent policy in place to support impoverished households and where the inhabitants' combined economic and social position, based on income, education, and occupation, were such that they qualified for state health support.

3.3.1 Study population

Health and preschool facilities situated in the low income suburbs draining to the TOHC were identified with the help of municipal and health officials. All facilities selected for inclusion in the sub-study were located in those areas. The selection of health services and educational/care facilities was aimed at obtaining a representative group of children who have not presented at a treatment facility with dental or oral health problems.

Healthy children younger than 6 years of age were selected from various preschools, community clinics, day hospitals, immunization clinics and well-baby clinics in these areas. The children selected to participate at the clinic sites were only those who accompanied other persons (mainly their caregivers) so that they were deemed to be 'healthy' (no obvious health complaints) at the time of the study. They came from all the communities selected from the low-income areas. In order to lessen the impact of possible selection bias (only children associated with health care institutions) the sample was extended to include children from the government-funded day care centres and crèches in the area. There was one

private crèche (preschool number 2) in the sample but this crèche only served children from poor families.

All children who were present on the day of the survey and who met the inclusion criteria were included in the survey. Surveys were carried out on different days of the week at different facilities to achieve a spread of weekdays. Children who were 6 years of age were also examined and their caregivers were given the benefit of receiving feedback and being referred to oral health services, but their information was not included in the data set.

3.3.2 Inclusion criteria

- All children older than 6 months and below 6 years of age who were present at the above-mentioned facilities on the day of the research visit and whose caregivers gave consent were selected for the survey.
- Children had to have erupted teeth to be included.

3.3.3 Exclusion criteria

- Children who were 6 years old or older at the time of the research visit were excluded from the study. Those 6-year-olds who were present were examined and feedback was given to parents or caregivers accompanying the children but the data was not included.
- Children presenting with a medical condition that could have a direct impact on oral health status were excluded.
- Children younger than 6 months without any erupted teeth were also excluded.

3.3.4 Preschools and crèches

The following preschools and crèches were included in the survey:

1. Aaron Figaji Preschool (Hercules Street, Bellville)
2. Curious Cuties Preschool (Maximillian Avenue, Glenhaven)
3. Hanzel and Gretel Preschool (Kasselsvlei Road, Bellville-South)
4. Heidi and Peter Preschool (McKenzie Street, Bellville)

School principals were approached for permission to conduct the study. The parents of children at the preschools and crèches, who were not present at the time of the dental examination, were provided with the necessary information regarding the study in writing. Consent forms were given to the children to take home for their parents to sign and were returned to the school. Children who did not have valid consent forms on the day of the

research visit were excluded from the study. Written consent was thus given for the oral examination of all children. After the examination was conducted, each child received a written note to take home informing their parents of the results of the examination. If further treatment was needed, contact details of the nearest facility where treatment could be sought was provided.

3.3.5 Community and well-baby clinics

The following health care facilities were selected:

1. Adriaanse Clinic (with a well-baby clinic)
2. Bellville South Community Health Clinic (with a well-baby clinic)
3. Bishop Lavis Community Health Clinic (community dentist on the same premises)
4. Elsies River Clinic (the second largest clinic in the study with a well-baby clinic)
5. Maitland Community Health Clinic
6. Goodwood Community Health Clinic (community dentist on the same premises)
7. Parow Municipal Clinic
8. Ravensmead Community Health Clinic
9. Scottsdene Community Health Clinic (the largest clinic in the study with a well-baby clinic)
10. St. Vincent's Community Health Clinic
11. Uitsig Clinic

Permission to visit the clinics and conduct the study was obtained from the provincial Department of Health and City Health (City of Cape Town) as well as the superintendent of each clinic included in the study. Healthy children accompanying their parents or caregivers to the healthcare facilities or children attending the clinic for reasons other than for oral health related problems were subjected to an oral examination. These parents also gave written consent for their children's mouths to be examined.

All consent forms were separated from data capture sheets so as to preserve patient anonymity. The attention of parents/ caregivers was particularly drawn to the fact that there were no indications of identity on the actual data capture sheets, but only on the separate consent forms. Parents/ caregivers placed the signed consent form into a sealed box (with a slot cut out in the lid) themselves. The completed data capture sheets were stored in a separate box, thereby preserving patient anonymity. These boxes were only opened after all the data had been collected. Immediate feedback was given to parents regarding any dental treatment their children required.

3.3.6 Sample size

A total of 700 children were examined. Of these, 41 were 6 years of age and were therefore not included in the study database. A total of 659 children between the ages of 6 months and just below 6 years comprised the final total.

3.3.7 Method of examination

Oral examinations were solely conducted by the author who is a registered dentist with a Masters degree in Paediatric Dentistry. These consultations were conducted free of charge. All children whose caregivers gave consent and who were willing to cooperate were examined in the waiting areas of the facilities. None of the parents refused the request to have their children's teeth examined and there were no issues regarding lack of cooperation on the children's part.

A simple, non-invasive method for caries detection was employed by making use of disposable tongue depressors. This visual method of caries detection was used with great success by Haleem et al (2009) who found it to be an acceptable alternative to using a dental mirror and probe, especially in the primary dentition. Toothpicks were used instead of a probe to remove debris from the tooth surface. It is a non-threatening approach which is especially useful when examining younger children (Haleem et al, 2009).

No sharp instruments or dental probes were used in this study as the intention was merely to record the presence of caries and thus assess the treatment need. The extent of the lesion and degree of cavitation of each individual tooth was therefore not recorded. Disposable gauze squares were used as an alternative to toothpicks to render the teeth plaque-free prior to examination. This method of plaque removal was also used in a study by Livny et al, (2007).

Tongue depressors facilitated the examination process as soft tissues like the tongue, lips and cheeks could be retracted, thereby improving vision and making diagnosis easier. The "lift the lip" technique as used by Livny et al, (2007) and Begzati et al, (2010) was also employed to examine the teeth in the anterior segment.

Visibility was not a problem and posterior teeth could be examined with ease. Haleem et al (2009) also found that visibility was not problematic and that this was due to the fact that the oral cavity is smaller.

Caries diagnosis was made on an entirely visual basis by the investigator who has more than ten years' clinical experience. Modified ICDAS and ICDAS-LAA criteria for visual detection of caries were followed (ICDAS II Criteria Manual, 2009).

According to the ICDAS-LAA criteria (ICDAS II Criteria Manual, 2009), lesions were charted as "active" if:

- They were covered in plaque
- The surface enamel was whitish/ yellowish
- There was a loss of lustre of surface enamel

Active decay indicated a need for dental treatment. Brown/ black lesions and shiny, enamel surfaces were recorded as inactive lesions. Carious lesions far from the gingival margin were also recorded as inactive (ICDAS II Criteria Manual, 2009).

As stipulated by the ICDAS criteria, teeth were then rendered plaque-free with gauze squares but a ball-ended probe was not used on incipient lesions (Diniz et al, 2009). Thus, the tactile component of ICDAS was not used in this study. The following criteria adapted from the visual ICDAS scale were noted:

- Sound teeth (Code 0)
- Early and distinct visual changes were charted as demineralized areas (Codes 1 & 2). These were non-cavitated lesions.
- Cavitations ranging from localized enamel breakdown and loss of surface integrity to extensive decay (Codes 3 to 6) were recorded but the degree of breakdown was not noted and distinction was not made between enamel and dentine caries.

The definition of ECC and s-ECC as proposed by the American Academy of Pediatric Dentistry (AAPD guideline, 2008; AAPD guideline, 2012-2013b) was used in this study. The presence of demineralized areas (incipient/ white spot lesions) on anterior tooth surfaces was also noted as it is indicative of the earliest manifestations of s-ECC. As cavitation had not yet taken place, these lesions were only recorded as demineralization and not as s-ECC.

Missing (due to extraction) and filled teeth were recorded as these variables indicate prior dental treatment. The presence of root rests, abscesses and soft tissue lesions were also noted together with reports of pain and the need for orthodontic treatment.

All the data collected was entered on a data capture sheet designed for this purpose. See Addendum A (data capture sheet).

3.4 Results

A total of 659 children were examined at the various facilities. Of these, 357 were male i.e. 54.2%.

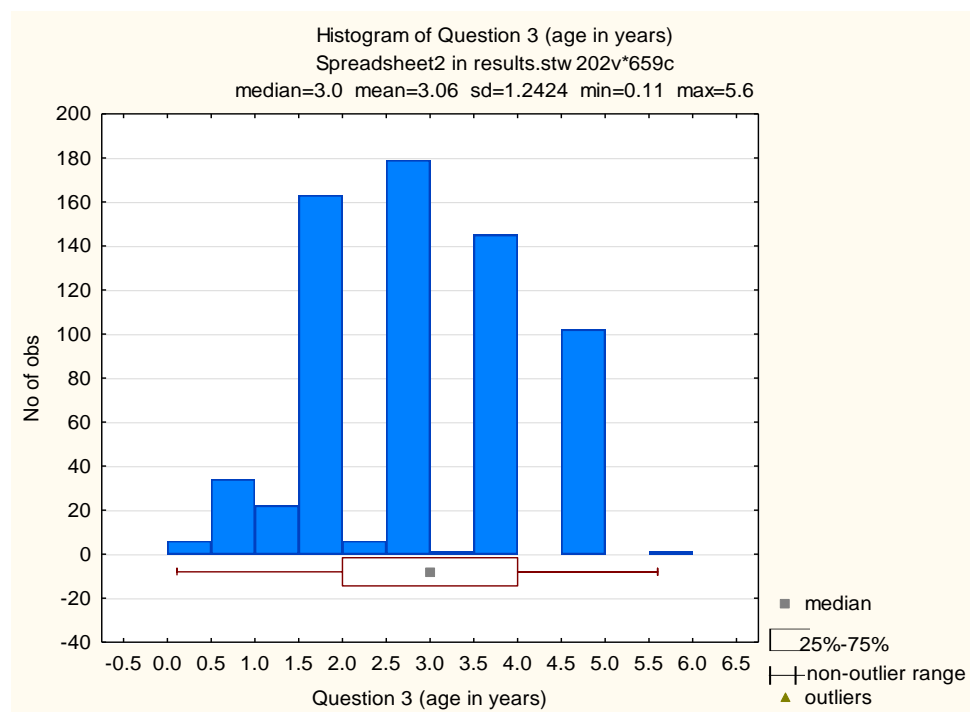
3.4.1 Composition of the study sample

Table 3.4.1.1: Composition of study sample per facility

Site/ facility		No. of children examined	% of total
Preschools	Preschool 1	44	6.7
	Preschool 2	67	10.2
	Preschool 3	63	9.6
	Preschool 4	20	3.0
Clinics	Clinic 1	77	11.7
	Clinic 2	34	5.1
	Clinic 3	26	3.9
	Clinic 4	94	14.3
	Clinic 5	4	0.6
	Clinic 6	11	1.7
	Clinic 7	14	2.1
	Clinic 8	22	3.3
	Clinic 9	147	22.3
	Clinic 10	31	4.7
	Clinic 11	5	0.8
TOTAL		659	100

Table 3.4.1.2: Age distribution of the study sample

Age distribution	No. of children	% of total (n=659)	No. of children with active caries per age group	% children with active caries per age group	% children with active caries of total group (n=659)
6 to 11 months	10	1.5	0	0.0	0.0
1 year to 1yr 11 mo	103	15.6	50	48.5	7.6
2 years to 2 yrs 11 mo	129	19.6	81	62.8	12.3
3 years to 3 yrs 11	172	26.1	128	74.4	19.4
4 years to 4 years 11 mo	142	21.6	105	73.9	15.9
5 years to 5 yrs 11 mo	103	15.6	81	78.6	12.3
Total group	659	100.0	445	67.5	67.5

**Figure 3.4.1.1: Age distribution [Question 3: How old is the child (years)?]**

3.4.2 Caries distribution versus age**Table 3.4.2.1: Overall caries distribution pattern per age group**

Age distribution	No. of children	% caries free per age group (n)	Total no. of children with caries per age group (%)	% with ECC per age group (n)	% with s-ECC per age group (n)	% with ECC and s-ECC per age group (n)	Differences in percentages
6 to 11 months	10	100	0	0	0	0	21.3 19.4 7.0 8.6
1 year to 1 yr 11 mo	103	49.5 (51)	52 (50.5)	3 (3)	41.7 (43)	5.8 (6)	
2 years to 2 yrs 11 mo	129	32.6 (42)	87 (67.4)	3.9 (5)	36.4 (47)	27.1 (35)	
3 years to 3 yrs 11 mo	172	22.1 (38)	134 (77.9)	9.9 (17)	21.5 (37)	46.5 (80)	
4 years to 4 yrs 11 mo	142	20.4 (29)	113 (79.6)	14.1 (20)	12 (17)	53.5 (76)	
5 years to 5 yrs 11 mo	103	16.5 (17)	86 (83.5)	16.5 (17)	4.9 (5)	62.1 (64)	

Table 3.4.2.2: Active caries distribution pattern per age group

Active caries per age group	% Active caries (n= 445)		
	s-ECC only % (n= 131)	ECC only % (n= 58)	s-ECC and ECC combined % (n= 256)
1 year to 1yr 11 months (n= 50)	82 (41)	6 (3)	12 (6)
2 years to 2 yrs 11 months (n= 81)	50.6 (41)	6.2 (5)	43.2 (35)
3 years to 3 yrs 11 months (n= 128)	25.8 (33)	13.3 (17)	60.9 (78)
4 years (n= 105)	11.4 (12)	18.1 (19)	70.5 (74)
5 years to 5 yrs 11 months (n= 81)	4.9 (4)	17.3 (14)	77.8 (63)

57.5% (i.e. 256/ 445) of children with active carious lesions presented with a combined ECC and s-ECC caries distribution pattern. Exclusive s-ECC made up 29.4% (i.e. 131/ 445) of the active carious lesions and 13% of the children displayed a caries distribution pattern for exclusive ECC.

A significant association was noted between age and the presence of active caries (Mann-Whitney test, $p = <0.01$).

Table 3.4.2.3: Active caries compared with age [Question 3: How old is the child? (years)
Question 4: Does the child have active caries?]

Question 4; LS Means (Spreadsheet2 in results.stw) Current effect: $F(1, 656)=44.408$, $p=.00000$ Effective hypothesis decomposition					
Question 4	Question 3 (age in years) Mean	Question 3 (age in years) Std. Err.	Question 3 (age in years) -95.00%	Question 3 (age in years) +95.00%	N
no	2.61009	0.08231	2.44846	2.77171	214
yes	3.27783	0.05714	3.16563	3.39004	444

3.4.3 Caries distribution pattern according to site

There was a significant difference in caries distribution pattern between the two sites (Chi-square test, $p=0.00$) with children at preschools displaying better oral health.

Table 3.4.3.1: Caries distribution pattern compared with facility [Question 1: At which site/ facility are the children examined? Question 5: What is the caries distribution pattern?]

Marked cells have counts > 10. Chi-square(df=3)=37.64, $p=.00$					
Question 1(2 groups)	Question 5 s-ECC	Question 5 ECC	Question 5 s-ECC and ECC	Question 5 Caries free	Row Totals
clinic	124	31	198	112	465
Row %	26.67%	6.67%	42.58%	24.09%	
pre-school	25	31	63	75	194
Row %	12.89%	15.98%	32.47%	38.66%	
Totals	149	62	261	187	659

Table 3.4.3.2: Active caries per site/ facility

Site/ facility		Total no. of children examined	No. of children with active caries	% of children needing treatment (per facility)
Preschools	Preschool 1	44	22	50.0
	Preschool 2	67	32	47.8
	Preschool 3	63	40	63.5
	Preschool 4	20	13	65.0
Clinics	Clinic 1	77	63	81.8
	Clinic 2	34	21	61.8
	Clinic 3	26	17	65.4
	Clinic 4	94	67	71.3
	Clinic 5	4	4	100.0
	Clinic 6	11	6	54.5
	Clinic 7	14	8	57.1
	Clinic 8	22	16	72.7
	Clinic 9	147	106	72.1
	Clinic 10	31	27	87.1
	Clinic 11	5	3	60.0
TOTAL		659	445	67.5

When preschool children were compared with children who presented at the clinics, the caries prevalence at the preschools was 55.1% compared to 72.7% at the clinics. This was statistically significant (Chi-square test, $p=0.0002$).

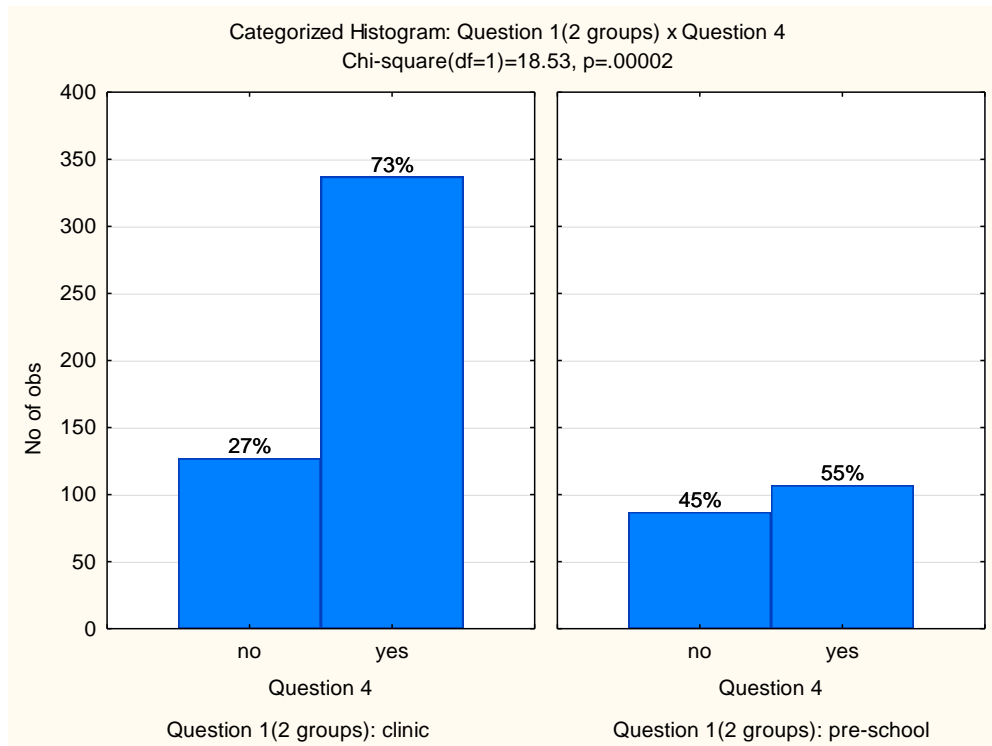


Figure 3.4.3.1: Caries prevalence compared with site [Question 1: At which site/ facility are the children examined? Question 4: Does the child have active caries?]

3.4.4 Caries distribution pattern according to gender

Table 3.4.4.1: Caries distribution according to gender

	Total no. of children with caries	s-ECC	ECC	Combined s-ECC and ECC
Total percentage affected	$(216 + 256) / 659 = 71.6$	$(68 + 81) / 659 = 22.6$	$(25 + 37) / 659 = 9.4$	$(123 + 138) / 659 = 39.6$
% of females	$216 / 659 = 32.8$	$68 / 659 = 10.3$	$25 / 659 = 3.8$	$123 / 659 = 18.7$
% of males	$256 / 659 = 38.8$	$81 / 659 = 12.3$	$37 / 659 = 5.6$	$138 / 659 = 38.8$
Ratio (gender differences)	216: 256 1 to 1.185	68:81 1 to 1.191	25:37 1 to 1.48	123:138 1 to 1.121

A total of 302 girls and 357 boys comprised the study sample. No significant association was found between caries prevalence and gender (Chi-square test, $p=0.27$).

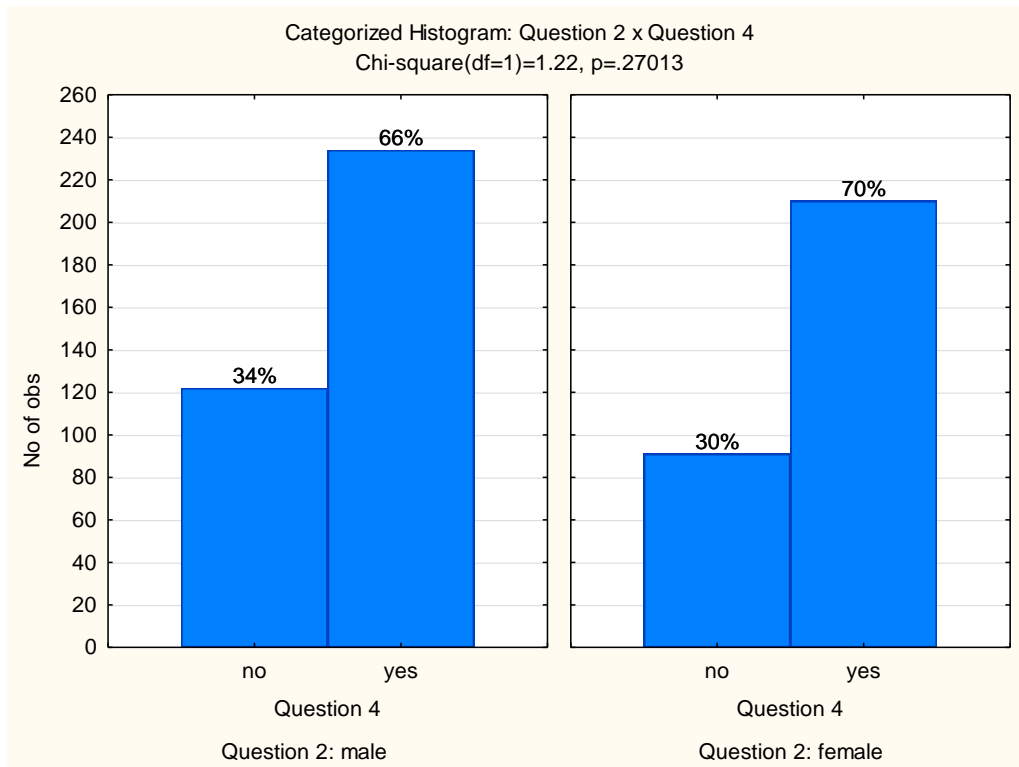


Figure 3.4.4.1: Association between caries prevalence and gender
[Question 2: What is the gender of the child? Question 4: Does the child have active caries?]

3.4.5 Overall caries distribution

Table 3.4.5.1: Overall caries distribution pattern

Caries distribution pattern	Number (n = 659)	% of total
s-ECC	149	22.6
ECC	62	9.4
s-ECC and ECC	261	39.6
Total number affected by caries, past or present	472	71.6
Caries free	187	28.4

From Table 3.4.5.1 it can be seen that the overall prevalence of dental caries in this prospective group of 659 children was 71.6%. Approximately 68% of children presented with active carious lesions that are in need of dental treatment (Table 3.4.2.2). The present study

calculates the overall unmet treatment need in children younger than 6 years of age to be 94.3% (i.e. 67.5/ 71.6 or untreated caries/ caries prevalence).

3.4.6 Previous dental treatment

Table 3.4.6.1: Previous dental history

	Number (n = 659)	%
No prior dental visit	552	83.8
Received previous dental treatment	107	16.2

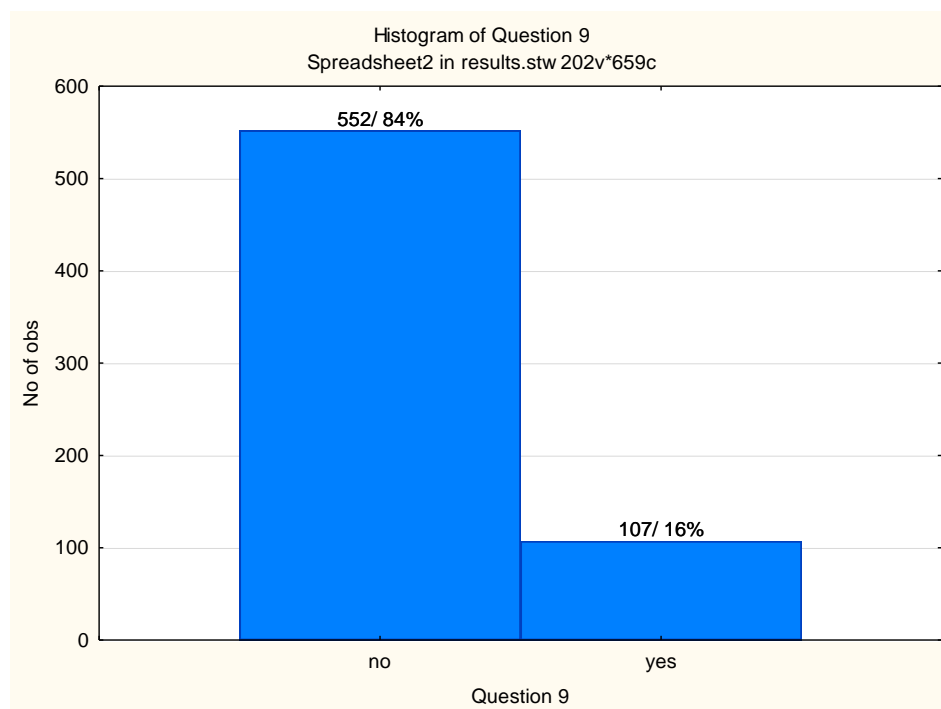


Figure 3.4.6.1: Previous dental treatment received [Question 9: Has the child been to a dentist before?]

Of the children that had previously visited a dentist, only 3 received restorative treatment. One hundred out of 107 children received extractions.

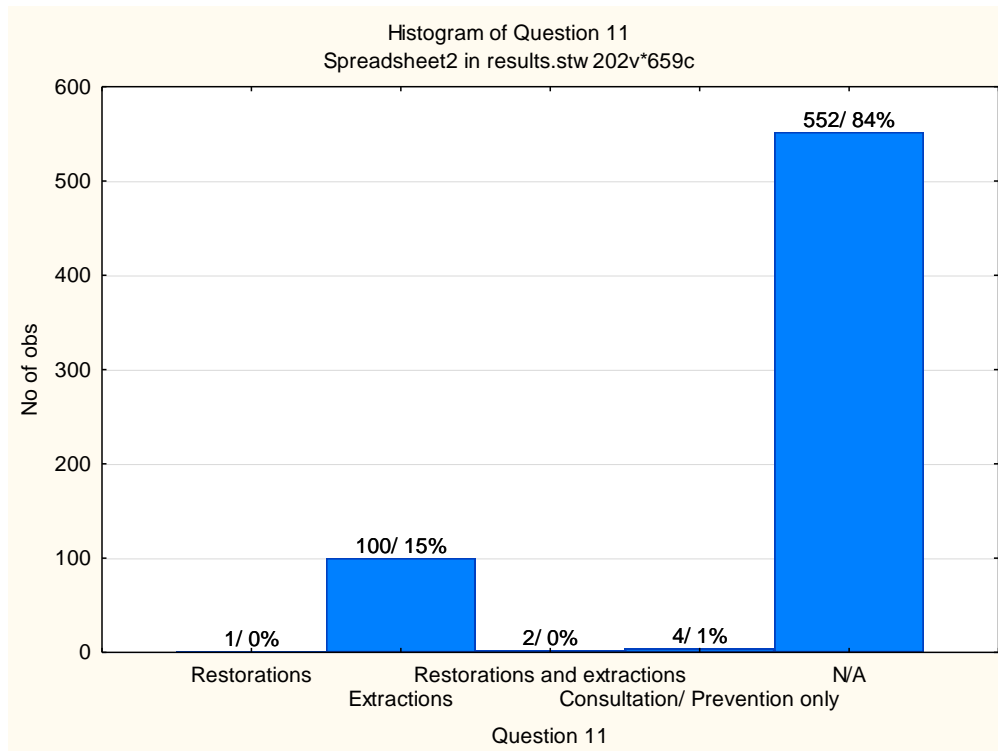


Figure 3.4.6.2: Type of dental treatment previously received [Question 11: For children who visited a dentist previously, what type of dental treatment did the child receive?]

3.4.7 Presence of pain

The vast majority of children (97.6%) did not present with pain.

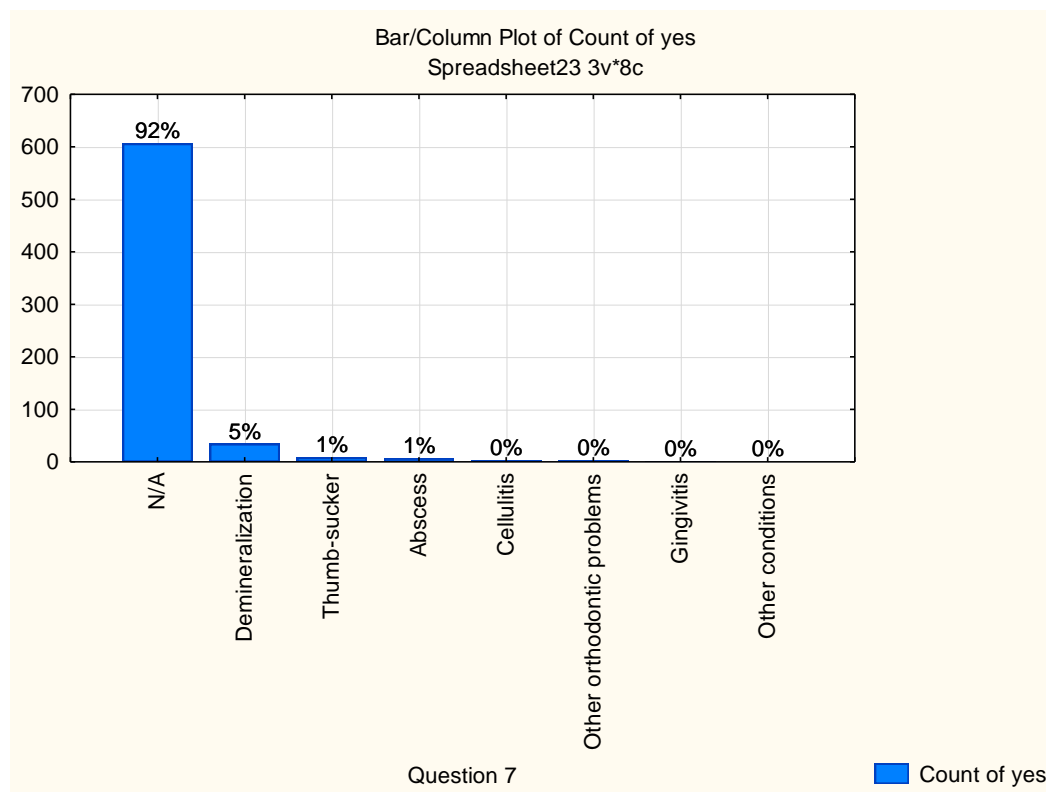


Figure 3.4.7.1: Other dental problems [Question 7: Does the child present with any other dental problems?]

3.4.8 Additional conditions

Table 3.4.8.1: Additional conditions noted

Condition	Number of observations (n=66)	% of total (n=659)
Abscess	8	1.2
Cellulitis	3	0.4
Demineralization	38	5.8
Gingivitis	3	0.4
Thumb-sucking	12	1.8
Other orthodontic problems	2	0.3
Total number of observations	66	10.0

3.5 Discussion

3.5.1 Prevalence

Anecdotal evidence suggests that ECC is a longstanding problem in the study area of the TOHC and local clinicians have suspected that the prevalence in the Cape Town metropolitan area is particularly high. This was confirmed by the present study where it was found that a disquieting 71.6% of children aged >6 months to <6 years of age were affected by caries.

The National Oral Health Survey (NOHS) conducted in South Africa over the period 1999 to 2002, was representative of all socio-economic groups (Van Wyk et al, 2004). The entire Western Cape was included in that survey and not just the Cape Town metropolitan area, while the present study only included the low-income areas of the City draining to the TOHC.

The NOHS revealed that caries prevalence in the Western Cape in the 4-to-5-year-old age group was estimated to be 77.1% at the time. This is far higher than the projected goal of 50% caries-free children set by the Department of Health for 2000 (Van Wyk et al, 2004). Eight years later, this goal has still not been achieved. In fact, there has not been any improvement, as in the present study, of the 245 children examined in the 4-to-5-year-old category, 186 of them i.e. 75.9% presented with active caries (Table 3.4.1.2). The total number of children in this age group that were affected by caries at some stage, past or present, comprised 199 children or 81.2% (i.e. 199/245). Refer to Table 3.4.2.1.

The difference in the prevalence of active caries between children at the clinics and those at the preschools was statistically significant (Figure 3.4.3.1). There was also a significant difference in caries distribution pattern between the two sites (Chi-square test, $p=0.00$) (refer to Table 3.4.3.1). Children at the preschools had a lower caries prevalence when compared to those examined at the clinics which suggests some type of “protective behaviour” at the preschools. Interviews with staff at the four preschools revealed that even though children only brushed their teeth at one of the preschools, all of the schools encouraged healthier eating habits and the drinking of lots of water. Since no interviews with parents/caregivers were possible, these differences could not be explored further. It also prevented these children from participating in the multivariate analysis model.

3.5.2 Caries distribution pattern

In the present study, the buccal surfaces of maxillary incisors were the most severely affected, indicating a caries distribution pattern of s-ECC as described in the literature by the American Association of Pediatric Dentistry (AAPD guideline, 2008; AAPD guideline, 2012-2013b). S-ECC was noted in 62.2% of the children examined. This number included children who had exclusive caries of their anterior teeth (22.6%) as well as those who presented with a combination of caries (39.6%) of the anterior and posterior teeth (Table 3.4.5.1). A significant association was noted between age and the presence of active caries as well as age and caries distribution pattern. Children as young as 1 year of age were affected by caries. Exclusive s-ECC was most prevalent in the 1-year to 1-year-11-month age category with 41.7% of children affected (Table 3.4.2.1). Implementing prevention at the time of tooth eruption or earlier, would therefore be most beneficial. In the older children, s-ECC was less prevalent but overall, as children got older, the number of caries-free dentitions decreased.

Changes in surface structure were noted and ranged from the presence of demineralization (which indicates the initial stages of the disease process) to cavitation lesions. Demineralization was noted in 36 subjects. These lesions have the potential to progress if left unchecked. Begzati et al (2010) demonstrated how quickly the carious process progresses. They found that of the 27 children who initially presented with early carious lesions, 18 of them progressed to a more severe form of ECC (with destruction of at least half of the crown) within a year of the initial visit (Begzati et al, 2010).

Thitasomakul et al (2006) reported a 'high rate of attacks on buccal surfaces of maxillary incisors' (p. 434). A comprehensive review of the emergency dental records at a paediatric teaching hospital between 1992 and 1994 revealed that the maxillary anterior teeth were affected in 26% of cases, followed by the lateral incisors and first molars (Sheller et al, 1997). Wanjau (2006) also found the upper incisors to be the most severely affected, followed by the lower molars and upper molars. After the maxillary anterior teeth, the mandibular first and second molars and maxillary first molars were found to be extracted most frequently (Sheller et al, 1997).

The lower incisors had the fewest recorded carious lesions (Wanjau 2006). These teeth are not only protected by the tongue during the feeding process, but are also situated in close proximity to the sublingual salivary glands, thereby having a more protective effect on these teeth (Brodeur & Galarneau, 2006). It is thought that as the upper incisors are amongst the first to erupt, they are exposed to the oral environment longer and are therefore affected

more severely (Brodeur & Galarneau, 2006). However, Thitasomakul et al (2006) showed that caries prevalence was high even when teeth were only in the mouth for a short period of time, indicating that the caries process starts as soon as the teeth erupt (Thitasomakul et al, 2006).

Studies conducted across different age categories and in relatively disadvantaged areas of India, Sri Lanka and the Philippines reported caries of the maxillary anterior teeth to be the most common with the maxillary central incisors being affected most severely (Tyagi, 2009; Kumarihamy et al, 2011; Cariño et al, 2003). In the Philippines, the presence of posterior caries was noted more regularly after the age of 3 years (Cariño et al, 2003). Forty-four percent of 4 and 5-year-old children in Jordan presented with caries of their posterior teeth with only 18% of them presenting with caries of their incisors alone (Sayegh et al, 2002).

The high prevalence of s-ECC in the present study highlights the huge impact of behavioural practices on the caries prevalence.

3.5.3 Age distribution

Caries has been shown to manifest from an early age (Cariño et al, 2003; Thitasomakul et al, 2006). Initial carious lesions on smooth surfaces were recorded in children falling into the 6-to-12-month age category (Mattos-Graner et al, 1996). In children younger than 12 months of age these lesions were found to be more prevalent than cavitated lesions (Mattos-Graner et al, 1996).

The prevalence of ECC in a group of Thai infants was shown to rise by 66% in a 9-month period and by 18 months of age, 68.1% of children were already affected by caries (Thitasomakul et al, 2006). Irrespective of socio-economic status, increased age has been associated with an increased prevalence and severity of decay (Schroth et al, 2010; Livny et al, 2007; Cariño et al, 2003; Hallett & O'Rourke, 2002; Sayegh et al, 2002; Bastos et al, 2008). This trend was confirmed in the present study as well where 48.5% (i.e. 50/ 103) of all 1-year-old children had active caries. Amongst the 5-year-old children, the number of affected children reached 78.6% (i.e. 81/ 103) indicating that the disease is more pronounced in older children. Refer to Table 3.4.1.2.

Caries prevalence ranged from 59% in 2-year-olds to 94% in 5-year-old Filipino children (Cariño et al, 2003). In a study conducted in North Brisbane, Australia, caries prevalence

was higher in 5-year-old children when compared with 4-year-olds (Hallett & O'Rourke, 2002). Both these studies were conducted in preschools but different diagnostic criteria were used to record the carious lesions. Even though similar trends in terms of caries progression were observed between the two studies, there was a huge difference in caries prevalence when the age groups in the two studies were compared. Approximately 30% of Australian 4-year-olds were affected compared with 90% in the same age category amongst Filipino children. A limitation of the Australian study is that the sample comprised different ethnic groups from varied socio-economic backgrounds yet caries prevalence was collectively determined (Hallett & O'Rourke, 2002). The sample size of the more affluent Caucasian group was approximately 7 times greater than all the other ethnic groups combined and this could be one of the reasons for the large discrepancies in caries prevalence between these two studies (Hallett & O'Rourke, 2002).

A study in Mexico revealed a prevalence of 8% in children between the ages of 1 and 2 years attending a pediatric dental clinic for the first time. Between 2 and 3 years of age, 32.3% of the children presented with caries and the highest caries prevalence was recorded in the 3-to-4 year age category where the prevalence reached 59.5% (Canseco et al, 2011). The Philippines had one of the highest recorded prevalences in this age group with an 85% caries prevalence recorded in the 3-year-old category and 90% being recorded amongst the 4-year-olds (Cariño et al, 2003). Up to 59% of Filipino 2-year-olds were affected by caries (Cariño et al, 2003).

In the present study, 62.8% of the 2-year-old children and 77.9% of 3-year-olds presented with active caries. The greatest increase in caries prevalence was noted between 1-year and 2-years-11-months of age (Table 3.4.2.1) while the prevalence peaked at 3 years of age where 74.4% (i.e. 128/ 172) of all children in this age category presented with active caries (Table 3.4.1.2). In contrast, approximately 25% of 3-year-olds in Mpumalanga were reported to have caries in 2006, which is lower than studies reported from other parts of the world (Wanjau, 2006). This highlights the fact that younger children should be targeted during preventative campaigns, especially those in the vulnerable 2-to-3-year age group. Early intervention introduced before the age of 3 years is therefore crucial to help curtail caries development in this vulnerable group.

Reasons for this high prevalence need to be investigated further, especially in this community which comprises mostly children from the so-called "coloured" population group.

Increased caries prevalence and severity has been reported in this population group (Van Wyk & Van Wyk, 2010).

3.5.4 Gender differences

For all caries distribution patterns in the present study, boys had a slightly higher caries prevalence. This was however not statistically significant (Figure 3.4.4.1). Studies in Australia, Brazil, India and the Philippines also reported similar trends (Hallett & O'Rourke, 2002; Ferreira et al, 2007; Tyagi, 2009; Cariño et al, 2003). It should be kept in mind that diagnostic criteria and age groups as used in the different studies varied. Yet, in all these studies, boys showed a slightly higher caries prevalence than girls. However, three of the studies mentioned that the difference between boys and girls regarding caries prevalence was not statistically significant (Hallett & O'Rourke, 2002; Ferreira et al, 2007; Tyagi, 2009). This was also found in Kosovo in preschool children between the ages of 1 and 6 years (Begzati et al, 2010).

In a Bedouin community 21% of boys and 13% of girls between the ages of 1 and 3 years presented with caries but even though the difference in caries prevalence was greater than that reported in other studies (Tyagi, 2009; Hallett & O'Rourke, 2002), this difference was reported to be statistically insignificant (Livny et al, 2007). Dogar et al (2011) reported an 8% difference in caries prevalence between genders in their study (which was statistically insignificant) with a higher caries prevalence also noted in boys.

Amongst Hutterite preschool children in Manitoba Canada, no difference was noted in the prevalence of ECC and s-ECC between males and females but it should be kept in mind that, with only 66 participants, this sample was relatively small (Schroth et al, 2010).

In contrast, a study in Mexico amongst 1-to-4-year-old children found a statistically significant difference in caries prevalence between boys and girls (Canseco et al, 2011). In the 14-to-24-month category, prevalence in boys was double that of the girls i.e. 10% versus 5.3%. However, in the 36-to-48-month category, 70% of girls were affected compared with 52% of boys. The sample size in this study was also small with a total of 100 children being included.

3.5.5 Treatment need

The majority of the children in the present study i.e. 67.5% (i.e. 445/ 659) had evidence of carious activity which needed some form of dental treatment (Refer to Table 3.4.2.2.). Preschool number 2 was the only site where less than 50% of the children needed dental treatment. In all other schools and clinics, 50% or more of the children were in need of dental treatment (Table 3.4.3.2).

The unmet treatment need is calculated by 'dividing the percentage untreated caries by the caries prevalence' (Van Wyk & Van Wyk, 2004, p. 374). Using this formula, the unmet treatment need of 4-to-5-year-old children in the Western Cape in the 2004 survey was calculated to be 93.3% compared with 94.3% for the present study. This shows that, to date, this problem has not been addressed at all.

Nearly all 3-to-5-year-old preschool children examined in Mpumalanga's Philadelphia district were in need of dental treatment with only 0.7% of affected teeth reportedly treated (Wanjau, 2006). A similar situation was reported in the northern Philippines where 59% of children aged 2-to-6-years were reported to be suffering from severe carious lesions that had already reached the pulp and needed to be treated (Cariño et al, 2003).

The untreated decay amongst minority groups is particularly high, with up to 91% of disadvantaged Hispanics in 3-to-4-year-old children in Manhattan and close to 70% of 1-to-6-year-old children amongst the Hutterite community in Manitoba, Canada requiring treatment (Albert et al, 2002; Schroth et al, 2010). More than 85% of 2-to-4-year-old children in rural and remote Australia presented with untreated decay (Dogar et al, 2011).

These findings attest to the need for increased efforts in these vulnerable communities (Albert et al, 2002; Cariño et al, 2003).

3.5.6 Types of dental treatment reported

Of the children surveyed in the present study, only 16.2% had been to a dentist before (Table 3.4.6.1). Children with a combined caries distribution pattern of s-ECC and ECC were more likely to have visited the dentist previously. Only 1 child, who presented with ECC exclusively, received previous dental treatment. In a study amongst the Hutterite community in Manitoba, Canada, Schroth et al (2010) found that children who visited the dentist did so due to problems with carious teeth and the caries status of these children was therefore significantly worse than those who had not.

In the present study, extractions were the treatment of choice in 102 of the 107 cases. Only 3 children had restorations placed (Figure 3.4.6.2). The numbers of restored teeth recorded in all age groups in the 2004 survey were also reported to be “negligible” (Van Wyk & Van Wyk, 2004). In a study conducted in Mpumalanga province in 2006, most parents opted to have their children’s teeth extracted (Wanjau, 2006). Sometimes, the degree of destruction to the primary dentition is so severe that extractions are the only treatment option. Begzati et al (2010) found that due to the destructive nature of the disease, 16% of children required extractions within a year after initial caries was diagnosed. The belief that ‘primary teeth will be replaced’ is one of the main reasons why the primary dentition is neglected and treatment is not sought by parents (Begzati et al, 2010, p. 5).

A study in Tanzania (Kikwilu et al, 2009) highlighted some of the issues that patients felt impacted on their decision not to seek dental treatment. Reasons included ignorance about restorative care, misinformation and previous unpleasant dental experiences. It was also clear that not many clinics in Tanzania were equipped to provide restorative care and few patients attended the dentist regularly. By the time patients require dental treatment, usually prompted by pain, the teeth are usually no longer restorable and have to be extracted (Kikwilu et al, 2009).

In a Bedouin community, the attitude of mothers towards dental treatment was reflected through their infrequent dental visits and the fact that their previous dental treatment consisted almost exclusively of extractions. This indicates that dental health was not regarded as a priority (Livny et al, 2007). Increased costs associated with dental treatment also contribute to the problem as parents do not seek dental treatment for their children (Kumarihamy et al, 2011; Kikwilu et al, 2009).

Similarly, in the Philippines, the number of preschool children who received dental treatment was generally low with only 32% of 3-to-4-year olds and 39% of 5-to-6-year old children having been to the dentist. Of these, almost half of them were treated for emergencies (Cariño et al, 2003). Filled teeth were also uncommon in other third world countries like Brazil (Peres et al, 2005).

This is in contrast with a study done in Brisbane, Australia where 15% of children aged 4-to-6 years had received restorative care. Fissure sealants were placed in 1% of these children (Hallett & O’Rourke, 2002). Only 3.7% were recorded as having had posterior teeth extracted and an additional 1% had ‘lost six or more primary anterior and posterior teeth’ (p. 335). In

9.4% of these children, missing teeth were presumed to have been lost to the normal exfoliation process. There is however a chance that these teeth were lost due to extraction and therefore the numbers of children reported as having received dental treatment could be an underestimate (Hallett & O'Rourke, 2002).

Schroth et al, (2010) reported that children who visited the dentist did so for problems with carious teeth and not for preventive reasons. Generally, in South Africa, the need for preventive and restorative treatment is greater than for extractions (Van Wyk & Van Wyk, 2004). The number of children needing treatment indicates that, due to a lack of resources, there are not enough dental services which target school children (Wanjau, 2006; Van Wyk & Van Wyk, 2010).

3.5.7 Presence of pain

Despite the high caries prevalence, only 16 out of the 659 children (2.4%) in the present survey claimed to experience pain. This was as a result of severe infections resulting from carious lesions that had progressed quite far. Of these, 7 children fell into the 4-year age group.

Due to its transient nature, the degree of dental pain is difficult to assess and this could also contribute to the fact that it often goes unreported (Low et al, 1999). Even though young children might not be able to verbalize that they are experiencing pain, loss of appetite and changes in sleep or behaviour patterns can be indicative of pain and discomfort (Low et al, 1999). As the presence of pain is usually relayed by the parents, especially in children, the actual number experiencing pain could be higher (Bastos et al, 2008).

In a study in the Philippines, 59% of children between the ages of 2 and 6 years had extensive decay of their teeth which involved the pulp. This means that these children were most likely experiencing pain and required emergency intervention. In 32% of these cases, this emergency visit was the child's first dental experience (Cariño et al, 2003). In a South African study by Wanjau (2006), most of the children examined in Mpumalanga province presented with pain.

The caries process progresses and becomes more severe as the child gets older and dental pain therefore tends to be reported more frequently with advancing age, especially around the age of 6 years (Bastos et al, 2008). For this reason, intervention should take place prior

to the age of 6 years, before the disease has progressed to such an extent that pain manifests and extraction of the tooth is warranted.

Extraction of decayed teeth resulting from severe pain can also leave children emotionally scarred. Tooth loss can cause eating difficulties, impaired oral function and problems with self-esteem. Orthodontic problems could also develop as a result. In 2004, 32.3% of all 12-year-old children surveyed were in need of orthodontic treatment (Van Wyk & Van Wyk, 2004).

In the present study, 12 children under the age of 6 years already presented with definite orthodontic problems stemming from previous dental extractions. Those in need of dental treatment might also need future orthodontic treatment with implied increased cost.

3.5.8 Access to health services

Where access to health care in South Africa is concerned, socio-economic status was shown to be a determining factor (Lalloo et al, 2004). Access to health care by the middle and lower socio-economic groups was more limited. The same should hold true for access to dental services. Patients from the poorer communities in particular could have a problem accessing state dental services (Lalloo et al, 2004).

In 2004, 84% of South Africans made use of state health facilities (Van Wyk & Van Wyk, 2004). These facilities would therefore be the ideal site for the implementation of more preventive and restorative services especially in younger children as they were found to be in greater need of dental treatment than children in the older age groups (Van Wyk & Van Wyk, 2004). As was reported by Wanjau (2006) in Mpumalanga province, the present survey also found that there were no structured preventive programmes at any of the clinics included in the study. Intervention is particularly needed in the poorer, disadvantaged sectors of the population (Petersen et al, 2005).

It appears that referrals to facilities for oral health in the present study were not being done optimally even where these services were reasonably accessible. Clinics at Bishop Lavis and Goodwood had community dental facilities situated next door, on the same premises. Despite this fact, more than 50% of the children who frequented these particular community health clinics were in need of dental treatment. Yet, patients were not referred to the dental clinics by the health care workers. This highlights the fact that the mindset of parents and

caregivers also needs to change from one where invasive treatment is sought for their children to an attitude directed more towards prevention.

Community dental clinics need to get more actively involved in their communities to promote prevention and provide more preventive and restorative services. Collaboration is therefore needed between the primary health care facilities such as clinics and dental clinics in order to ensure the optimal overall health and well-being of patients.

At present, the TOHC is the only facility in the Western Cape that provides a comprehensive service that is accessible to the general public. This service (which includes general anaesthesia and sedation) encompasses all aspects of dentistry for the paediatric patient. The enormous number of children requiring treatment implies huge clinical case loads as it puts a strain on the growing sedation and general anaesthesia waiting lists and has economic implications for public dental services.

With a shrinking health budget and the arrival of infectious diseases of epidemic proportions such as HIV/ AIDS, the prevention of ECC and its consequent cost savings can be an extremely positive investment of health funds (Losso et al, 2009).

3.6 Conclusion

The World Health Organization goal for various oral health indicators, including ECC stipulated that by 2010, 90% of 5-year-old children should be free of caries (Hobdell et al, 2000). Despite the fact that a taskforce was established (as part of a global initiative) to improve the oral health of children in countries throughout the world, including South Africa (Van Wyk & Van Wyk, 2010), the present situation suggests that this is an unrealistic and unattainable goal. At the present prevalences found in this study, the study area will not even approach this goal by any means.

From the high caries prevalence of 71.6% found in this study in children under the age of 6 years, it is evident that this problem has not received the attention it deserves. This means that there will be a greater demand for dental services including the more expensive sedation and general anaesthesia services. As the TOHC is the only facility in the Western Cape that provides a comprehensive dental service to the general public, the demand for these services is currently not being met. Waiting lists are growing by the day which places a tremendous strain on resources as well as the workforce who has to deal with this problem.

Children with dental problems usually grow up to be adults with dental problems, thereby perpetuating the negative attitudes towards dental health. The severity of the problem in this study population has highlighted the need to target younger children, especially in the poorer communities. The current situation is a red flag which indicates the urgent need for intervention to address this public health problem that has reached epidemic proportions in the Western Cape.

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CHAPTER 4

SUB-STUDY ON ATTITUDES, KNOWLEDGE AND HABITUAL CAREGIVER BEHAVIOUR IMPACTING ON CHILDREN'S ORAL HEALTH

4.1 Introduction

Caries is multifactorial in nature (Twetman, 2008; De Grauwe et al, 2004). Apart from socio-demographic and microbiological factors, parental behaviour such as feeding and oral hygiene practices have been shown to influence the development of caries (Petersen, 2005; Finlayson et al, 2007). Child-rearing practices such as prolonged use of a feeding bottle containing sweetened substances have been positively linked to children's poor oral health, especially during infancy and preschool years (Chu, 2006; Ölmez et al, 2003).

Parents are generally considered to be the primary caregivers and play an important role in shaping attitudes and behaviour towards dental care (Okada et al, 2002; Mohebbi et al, 2008). Good oral hygiene habits are established early, with the mothers being the primary role models (Okada et al, 2002; Mohebbi et al, 2008).

Mohebbi et al (2008) suggested that oral hygiene of children would improve if more attention was given to the oral hygiene of their mothers. Active participation in caring for their children's teeth should also be encouraged (Mohebbi et al, 2008). A positive maternal attitude towards dental care was shown to be associated with improved oral hygiene and fewer carious lesions in their children (Adeniyi et al, 2009). A 'fatalistic' attitude to oral health triples the odds of children developing caries (Finlayson et al, 2007). Thus, by reinforcing this positive attitude amongst mothers, not only will their own dental health improve, but their children will benefit as well (Adeniyi et al, 2009).

This is particularly important if one takes into consideration that *Streptococcus mutans* (MS), the micro-organism known to be associated with dental caries, is usually transmitted from mother to child, especially mothers with higher levels of MS in their saliva (Douglass et al,

2007). The chance of transmission is higher during the window of infectivity which falls within the first two years of birth (Prakash et al, 2012). Reduction of MS counts through interventions like introduction of fluoride and chlorhexidine preparations, provision of restorative care and improvement in oral hygiene practices, have been shown to result in lower MS counts in the children of these mothers (Douglass et al, 2007). Xylitol-containing chewing gum has been shown to significantly reduce the transmission of *Streptococcus mutans* between mother and child and was more effective than chlorhexidine and fluoride varnish treatments (Söderling et al, 2000).

Behavioural factors may be culturally determined as certain lifestyle choices can be associated with a particular culture (Petersen, 2005). By focusing on parental beliefs and understanding the reasons why parents behave in a certain manner, it may be possible to get to the root of the problem and put systems in place which will help implement behaviour change. Therefore, in order to educate parents, one must be familiar with their beliefs and practices (Petersen, 2005).

Social and biological factors such as illness, family income (Ramos-Gomez et al, 2002), parental education (Ramos-Gomez et al, 2002; Peres et al, 2005; Chu, 2006), and other behavioural factors that a child is exposed to early in life, can have an impact on general health as well as dental health in later years (Peres et al, 2005; Chu, 2006). Many of the risk factors for the development of caries are associated with social deprivation and poverty. Dental caries is positively associated with low socioeconomic status and was also shown to be common amongst minority and immigrant populations (Chu, 2006; Finlayson et al, 2007). ECC was prevalent in a large percentage of children among low-income African American children in Detroit indicating that this was a high risk group (Finlayson et al, 2007). As income declines, the level of education, lifestyle and access to health care and information also decreases (Prakash et al, 2012).

Clinical and epidemiological data have shown that there is a strong association between nutrition and the state of the oral cavity (Touger-Decker & Mobley, 2007; Peres et al, 2005). Oral infectious diseases, as well as acute, chronic, and terminal systemic diseases with oral manifestations, impact on the functional ability to eat as well as diet and nutritional status. This in turn influences general health and well-being (Petersen, 2005).

Nutrition is related to (or influenced by) financial status. Parents living in poverty are often not able to obtain stable employment and therefore most likely cannot provide adequate housing

or proper nutrition for their families. Financial stresses also often mean compromised health care which results in increased susceptibility to illness and poorer quality of life (Petersen, 2005).

Malnutrition can be a reliable indicator of stress and subsequent increased caries risk. It can manifest as a height by age deficit. This was demonstrated using the international growth curves reference of the National Centre for Health Statistics (Peres et al, 2005). A higher percentage of low caries risk children tend to be of normal weight at birth as opposed to children with a higher caries risk, thus indicating better overall health (Chu, 2006). Reduced salivary flow and buffering capacity of saliva in malnourished children could also predispose them to caries development (Psoter et al, 2008). Decreased salivary flow at night allows substances to pool around the teeth, making them more susceptible to caries (Prakash et al, 2012). Feeding habits such as nocturnal feeding practices and extended periods of bottle- and breastfeeding are therefore also detrimental to oral health (Prakash et al, 2012; Bowen & Lawrence, 2005).

Children from a lower socio-economic group tend to have limited access to dental care (Plutzer & Spencer, 2008) and are more likely to receive treatment at public community health clinics or teaching hospitals which have long waiting lists. This means that access to care is delayed, thereby exacerbating the problem by allowing the child's oral health to deteriorate further. This situation is certainly reflected at the TOHC where most of the patients originate from economically disadvantaged areas.

A previous retrospective study conducted at Tygerberg (Mohamed & Barnes, 2008), highlighted certain negative behavioural patterns that needed further investigation. All the children in that study were treated for extractions at the TOHC. It was found that all the children were either breast- or bottle-fed past one year of age. Caregivers reported that more than 90% of the children went to sleep with the bottle or fell asleep while on the breast and were fed on demand during the night. On average, breastfeeding was stopped at 9 months of age compared to bottle-feeding which, on average, was stopped at a much later age of 23 months. Where oral hygiene practices were concerned, 52.6% of children brushed their own teeth without supervision. Frequency of brushing varied between subjects. These high risk practices were associated with increased caries prevalence.

It is clear that many factors influence compliance. Reasons for lack of compliance need to be investigated further. Biological risk factors and social factors are intertwined. Microbiological

factors are difficult to control but behavioural patterns (which include oral hygiene practices and dietary habits) and social and environmental aspects can be addressed in order to effect change.

The present survey has been planned to investigate the knowledge, attitudes and behaviour of the caregivers of children in the target population who presented with ECC at various clinics draining to the TOHC.

4.2 Aims of the sub-study

1. To investigate the knowledge and practices of caregivers regarding general oral health in their children.
2. To investigate the factors (behavioural, social and environmental) associated with signs and symptoms of ECC in their children.
3. To gain insight into the practices and knowledge of these caregivers regarding ECC in these children.

4.3 Methods

A survey was carried out at various community-based clinics, day hospitals, immunization clinics and well-baby clinics in the economically disadvantaged housing areas draining to the TOHC. The available facilities in the drainage area were identified with the aid of the municipal and health officials and health service facilities were selected with their help. The areas that were known to municipal authorities as low income areas, based on their indigent policy as well as valuation of properties were identified. The following facilities were selected:

1. Adriaanse Clinic
2. Bellville South Community Health Clinic
3. Bishop Lavis Community Health Clinic
4. Elsies River Clinic
5. Maitland Community Health Clinic
6. Goodwood Community Health Clinic
7. Parow Municipal Clinic
8. Ravensmead Community Health Clinic
9. Scottsdene Community Health Clinic
10. St. Vincent's Community Health Clinic
11. Uitsig Clinic

Permission to carry out this study was obtained from the Department of Health of the Western Cape and City Health (City of Cape Town). Permission was also sought from the head of each facility included in this study.

Interviews were conducted with the parents/ caregivers of those children investigated under Sub-study 1 for whom participation could be secured. This was done in order to gain insight into child-rearing practices and habits that could have contributed to the poor dental health of their children.

4.3.1 Inclusion criteria

Parents/ caregivers presenting at the above-mentioned facilities who were accompanied by children older than 6 months and younger than 6 years of age were approached to participate in the study.

4.3.2 Exclusion criteria

1. Interviews were not conducted with parents of children who presented with a medical/ dental condition that would have a direct impact on their oral health status.
2. Parents/ caregivers who were unable to speak English or Afrikaans were excluded from this part of the survey as the author is only able to communicate effectively in these two languages. This criterion was set a priori but was not needed as all parents/ caregivers could speak either English or Afrikaans.

Even if the inclusion criteria were not met, no child was turned away and parents were still given advice regarding their child's oral health status if they requested it. It should be noted that communication was not a problem as all participants could speak either English or Afrikaans. Parents/ caregivers were informed of the results of the examination and directed to the nearest dental care facility if their child required any dental treatment.

The parental structured interview was conducted with the aid of a formal survey questionnaire (see Addendum C). The questionnaire was developed with the aid of information contained in the retrospective patient records in the records archive of the TOHC. All the records in this archive relating to patients under 6 years old were conducted by the candidate herself (Mohamed & Barnes, 2008). This questionnaire was thus, to some extent, environment-specific as it included locally available dental products and also took note of local customs and beliefs. This questionnaire was developed as an information-gathering tool and was not meant to be validated. Validation involves a known answer against which the

newly developed questionnaire could be 'bench-marked' - a situation that does not exist in the present case.

The survey was conducted in the waiting area of the clinics. Written consent was obtained from the parents/ caregivers to examine the children's mouths and to use the information gathered from the interviews in the research project (See Addendum B- consent form). The nature of the oral examinations has already been described in Chapter 3.

If a parent/ caregiver had more than one child accompanying them, separate interviews were conducted for each child. However, only one consent form was completed per caregiver/ parent but the number of children for whom interviews were conducted was noted on the consent form. Consent forms and data capture sheets were placed into separate sealed boxes with postal slots cut into the lids so as to preserve participant anonymity. This way, the identities on the consent forms could not be matched with the completed data capture sheets. These boxes were only unsealed at the end of the study when all forms had been collected. The number of caregivers/ parents and the numbers noted on the children's forms were then tallied.

Interviews were conducted by the author herself who has a Masters degree in Paediatric Dentistry and more than 10 years' clinical experience. For every child who was accompanied by a caregiver or parent, an in-depth structured interview was conducted. In order to standardize the way questions were phrased, questions were written out in full sentences and read word-for-word from the questionnaire (See Addendum C- full questionnaire). Questions regarding lifestyle, child care, knowledge of oral health, behavioural patterns and habits were included in the interview so as to investigate the impact of these factors in the development of ECC. Details regarding the child's dental and medical history as well as specific feeding and oral hygiene practices were noted. Responses were recorded in summarized form on a data capture sheet (See Addendum D- data capture sheet).

The data were captured by the candidate herself and sample data sheets were selected for data capture verification. No mistakes were found in the verification sample.

4.4 Results

A total of 366 interviews were conducted with the caregivers at the clinics who were accompanied by children under 6 years of age i.e. 56% of all the children examined were accompanied by caregivers with whom interviews were conducted. A brief oral examination was performed on each child as previously described.

4.4.1 Distribution of parental interviews

Table 4.4.1.1: Distribution of parental interviews conducted at each facility

Site/ facility	Number of interviews	%
Clinic 1	76	20.8
Clinic 2	34	9.3
Clinic 3	26	7.1
Clinic 4	92	25.1
Clinic 5	4	1.1
Clinic 6	11	3.0
Clinic 7	14	3.8
Clinic 8	22	6.0
Clinic 9	51	13.9
Clinic 10	31	8.5
Clinic 11	5	1.4
TOTAL	366	100.0

4.4.2 Social History

The age range of parents interviewed is reflected in Table 4.4.2.1.

Table 4.4.2.1: Age of primary parental caregiver

Age	Number	%
15 to 19 years	19	5.2
20 to 24 years	94	25.7
25 to 29 years	86	23.5
30 to 34 years	78	21.3
35 to 39 years	60	16.4
40 to 44 years	13	3.5
45 to 49 years	7	1.9
50 + years	1	0.3
Age unknown	8	2.2
TOTAL	366	100.0

There was no significant association between parental age and active caries prevalence in their children (Mann-Whitney test, $p = 0.5$). Of the 366 caregivers interviewed, 283 (77%) did not know that caries is an infectious disease that could be transmitted by sharing the same spoon or toothbrush.

Table 4.4.2.2: Parental age compared to caries prevalence (statistics as obtained from a printout of the computer analysis)

[Question 4: Does the child have active caries? Question 46: What is the age of the parent?]

Question 4; LS Means (Spreadsheet2 in results.stw)						
Current effect: $F(1, 390) = .45490$, $p = .50041$						
Effective hypothesis decomposition						
Cell No.	Question 4	Question 46 Mean	Question 46 Std.Err.	Question 46 -95.00%	Question 46 +95.00%	N
1	no	28.9607	0.70522	27.5742	30.3473	102
2	yes	29.5137	0.41824	28.6915	30.3360	290

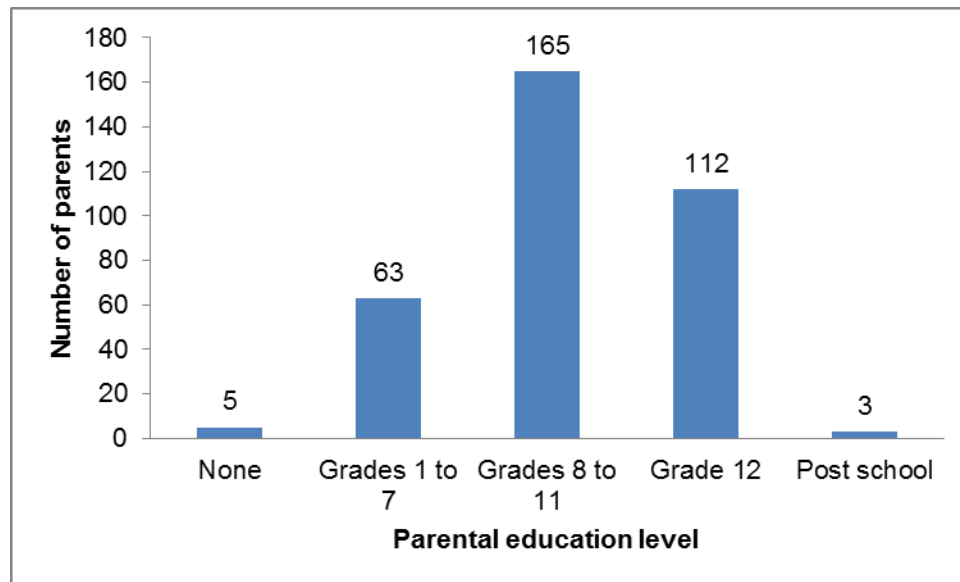


Figure 4.4.2.1: Known parental education levels

Where education was concerned, information could only be obtained for 348 parents. Of these, 234 (67.4%) of parents had not completed a high school leaving certificate (Grade 12). No significant association was demonstrated between parental education level and caries prevalence (Chi-square test, $p = 0.41$).

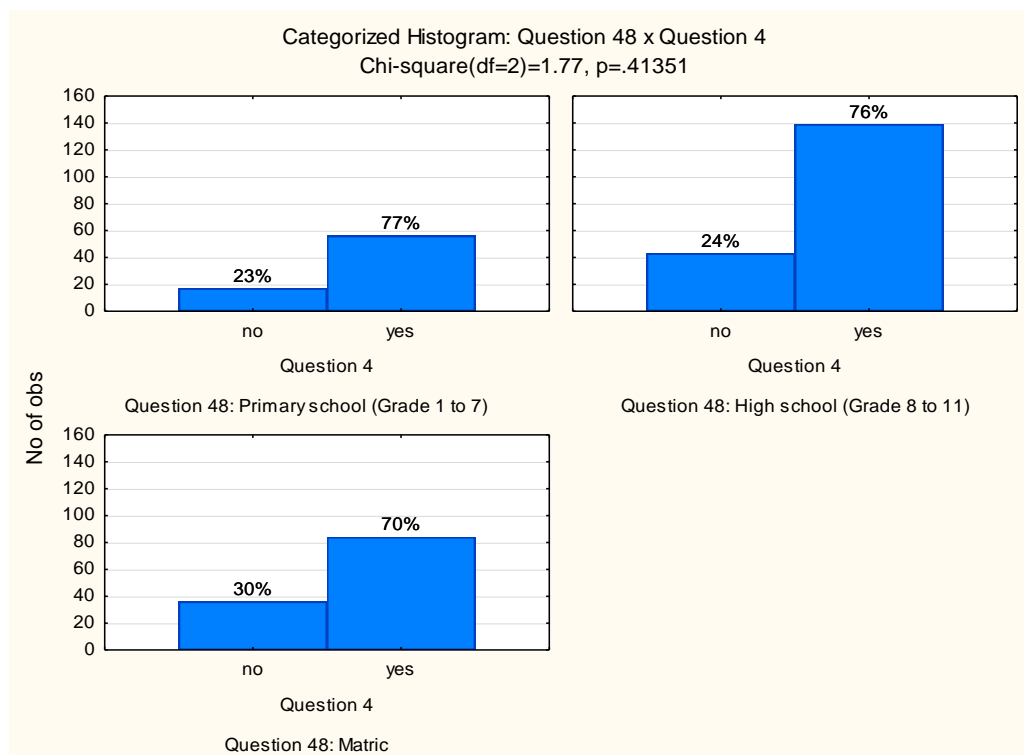


Figure 4.4.2.2: Parental education level compared with caries prevalence [Question 4: Does the child have active caries? Question 48: What is the parent's education level?]

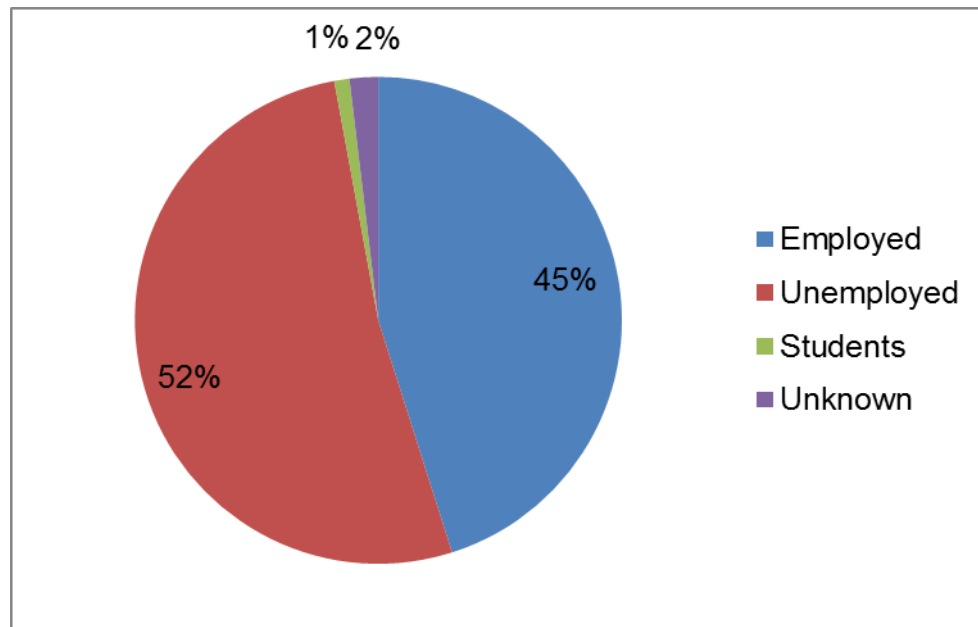


Figure 4.4.2.3: Parental employment status

Parental unemployment status was not significantly associated with caries prevalence in their children (Chi-square test, $p = 0.30$).

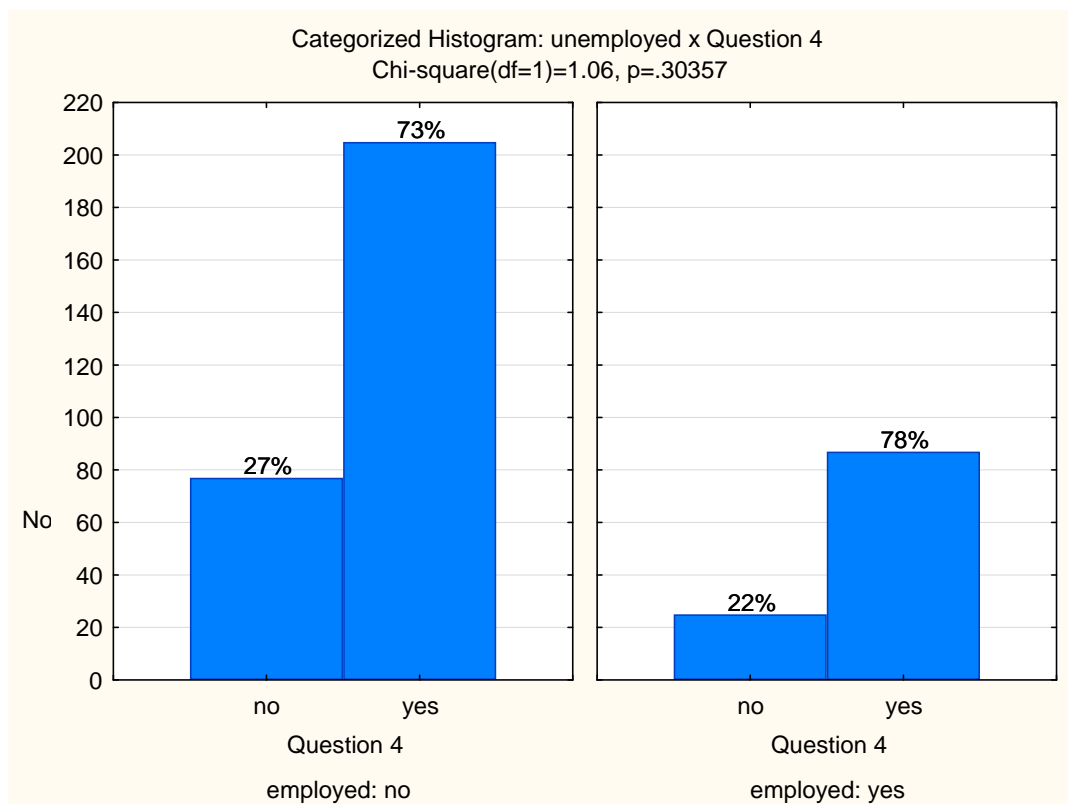


Figure 4.4.2.4: Caries prevalence by caregiver employment status

[Question 4: Does the child have active caries?]

Table 4.4.2.3: Job distribution for parents who were formally employed

Job category	Examples of jobs in each category	Number	%
Professional	Teacher, stenographer, nurse	3	1.8
Administrative	Admin clerk, receptionist, bank clerk	14	8.5
Retail	Sales person at retail outlets/ clothing stores	7	4.3
Manual labour/ semi-skilled	Machinists, textile printers, chef, hairdresser, dispatcher, data capturer	48	29.1
Self-employed		2	1.2
Unskilled	Dishwasher, caregiver, stock taker, factory worker, workers at fast food outlets/ grocery stores, packer, driver, cleaner, waitress, farm worker	86	52.1
Has job—unspecified		3	1.8
Has job—don't know		2	1.2
TOTAL		165	100.0

In 92 homes, at least one person was unemployed i.e. 25% of cases. One hundred and two homes (27.9%) had two or more unemployed adults. In 152 of the 366 households (41.5%), only 1 adult had a permanent job. There were only 2 recorded instances where 6 adults from one household all had permanent jobs. In approximately 11% of households, at least one member had a casual job.

Table 4.4.2.4: Marital status

Marital status	Number	%
Single	187	51.1
Engaged	3	0.8
Separated	1	0.3
Divorced	7	1.9
Widowed	1	0.3
Living together	12	3.3
Married	148	40.4
Status unknown	7	1.9
TOTAL	366	100.0

Parental marital status was not significantly associated with caries prevalence (Chi-square test, $p = 0.14$)

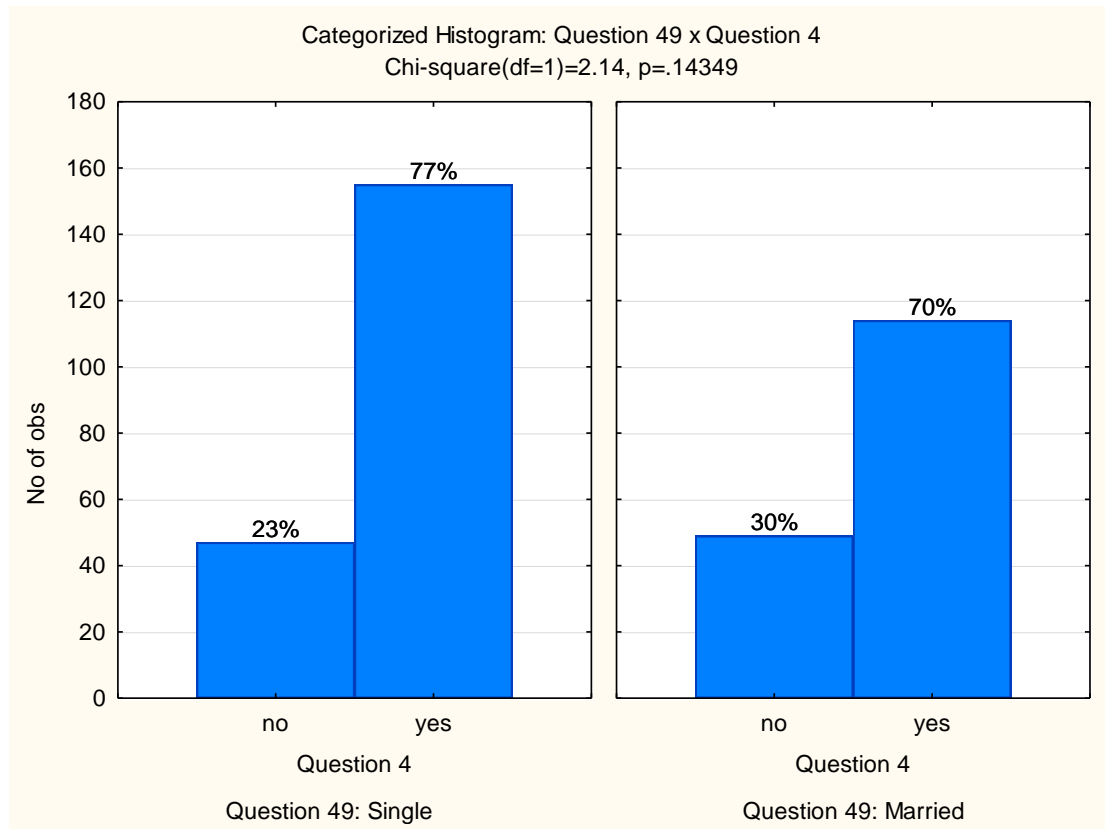


Figure 4.4.2.5: Parental marital status compared with caries prevalence [Question 4: Does the child have active caries? Question 49: What is the marital status of the parent?]

Forty-two households relied on disability grants with 13 of these families consisting of 4 or more adults in the household. Sixteen families, all of which consisted of extended family members with 4 or more people per household, depended on the pension of at least one family member in order to make ends meet. Only 5 mothers claimed to receive child support and 4 mothers listed alternative sources of income in cases where there were no working adults in the home.

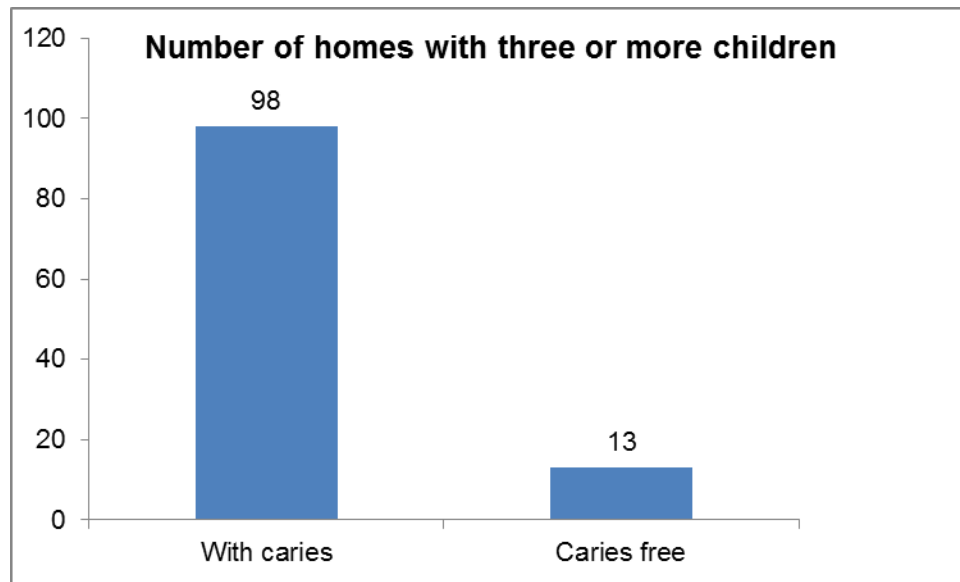


Figure 4.4.2.6: Caries prevalence vs. family size

In homes with 3 or more children, caries prevalence amongst the children was significantly higher (Chi-square test, $p = 0.01$).

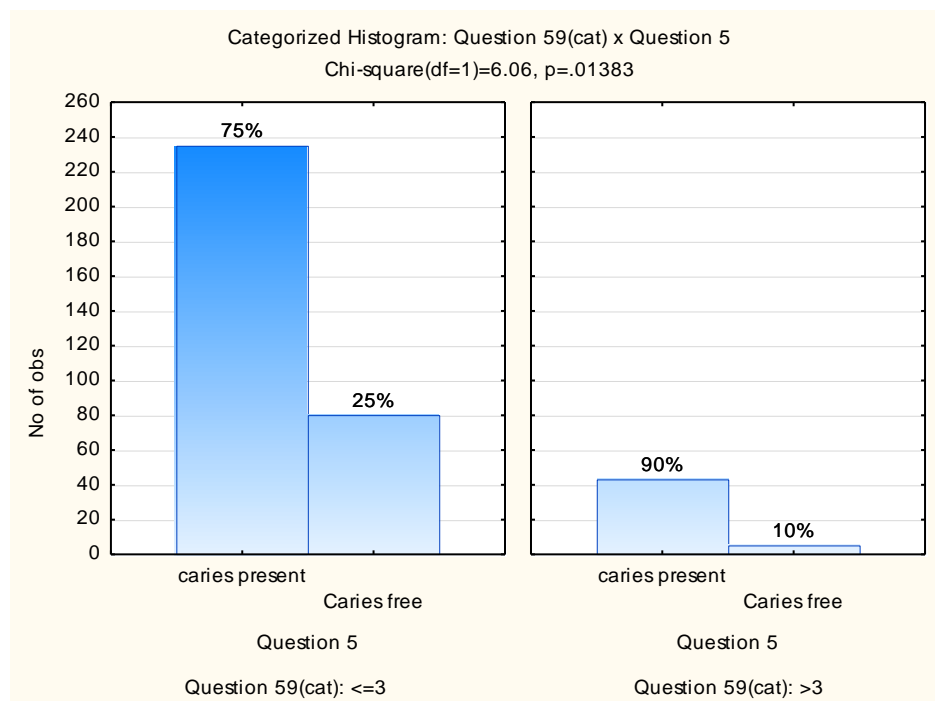


Figure 4.4.2.7: Number of children in the home compared with caries experience [Question 5: What is the caries distribution pattern of the children? Question 59: How many children are living in the home? (≤ 3 vs. > 3)]

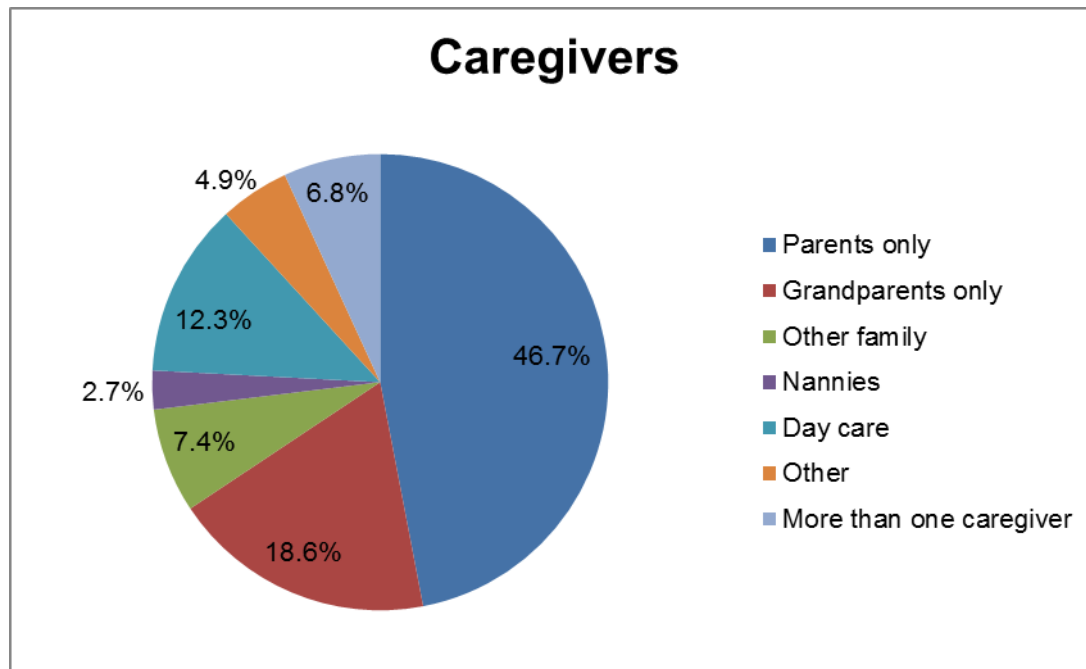


Figure 4.4.2.8: Caregivers during the day

During the day, the biological/ foster parents were the sole caregivers in 46.7% of cases (i.e. 171/ 366). Of these, 158 out of 171 parents were mothers. In 13 of the families, these parents shared this responsibility with nannies (8 cases) and grandparents (5 cases). Grandmothers constituted the second largest group of caregivers during the day (18.6%) followed by day care or school (12.3%).

4.4.3 Feeding practices

Table 4.4.3.1: Feeding practices

Feeding practice	No of children	Percentage of children per category (%)	No of children per category with caries	No of caries-free children per category
Bottle-feeding only	95	25.9	74	21
Breastfeeding only	65	17.8	46	19
Breast- and bottle-feeding	199	54.4	154	45
Blank/ don't know	7	1.9	7	0
TOTAL	366	100.0	281	85

Only 65 children (18%) were exclusively breastfed and 95 (26%) were exclusively bottle-fed. The remainder (206; 56%) received both breast- and bottle-feeds.

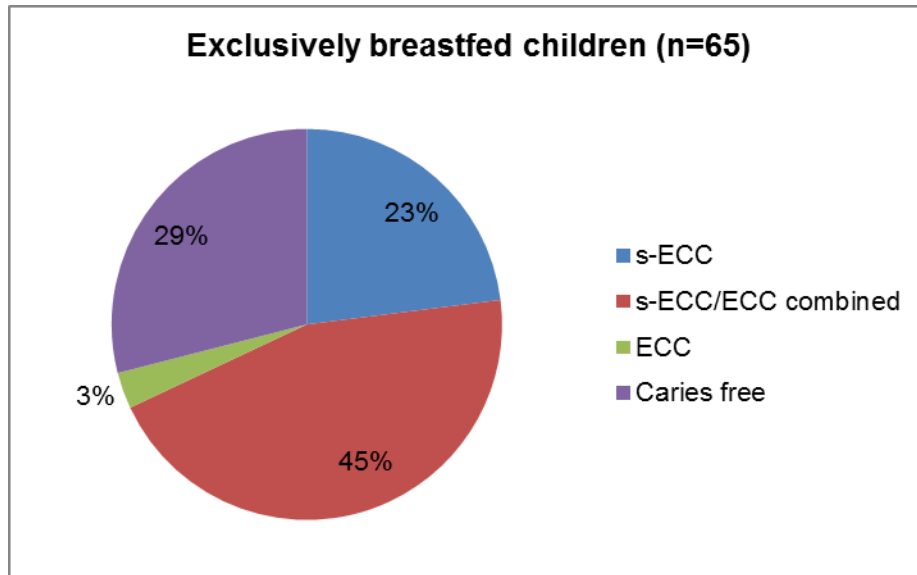


Figure 4.4.3.1: Caries distribution pattern for exclusively breastfed children

Bottle-feeding (Chi-square test, $p = 0.008$) was shown to have a significant association with parental education levels but breastfeeding did not (Chi-square test, $p = 0.74$).

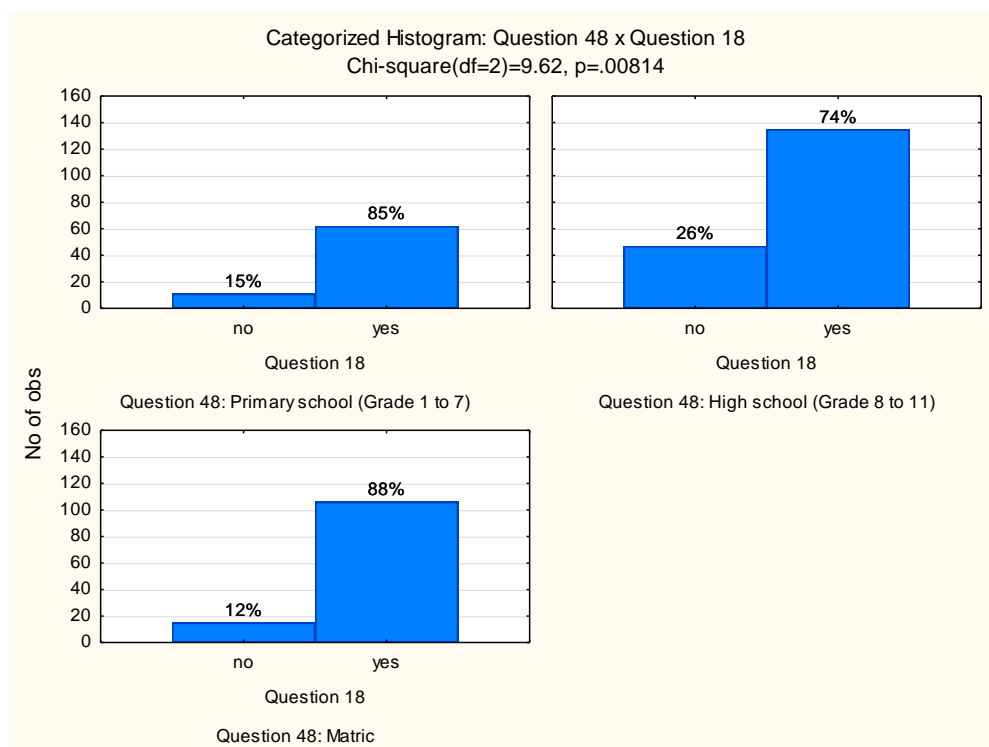


Figure 4.4.3.2: Parental education level compared with bottle-feeding practices [Question 18: Was/ is the child bottle-fed? Question 48: What is the parental level of education?]

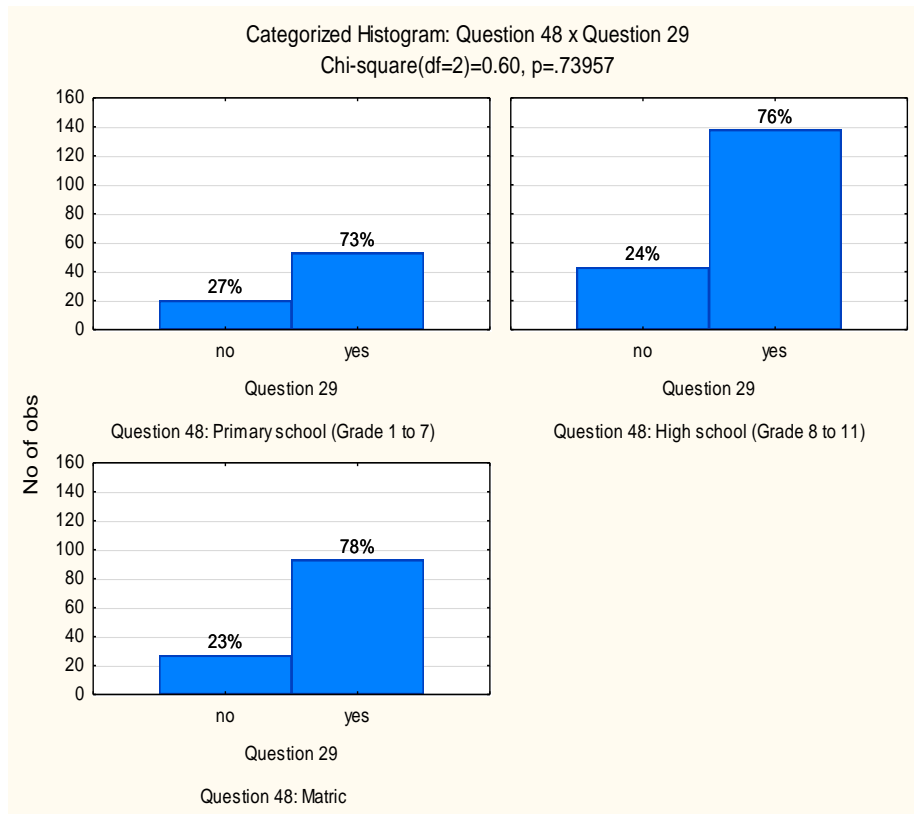


Figure 4.4.3.3: Parental education level compared with breastfeeding practices [Question 29: Was/ is the child breastfed?
Question 48: What is the parental level of education?]

No significant association was noted between caries prevalence and the type of feeding practice (Chi-square test, $p = 0.52$ and 0.64 for bottle-feeding and breastfeeding respectively).

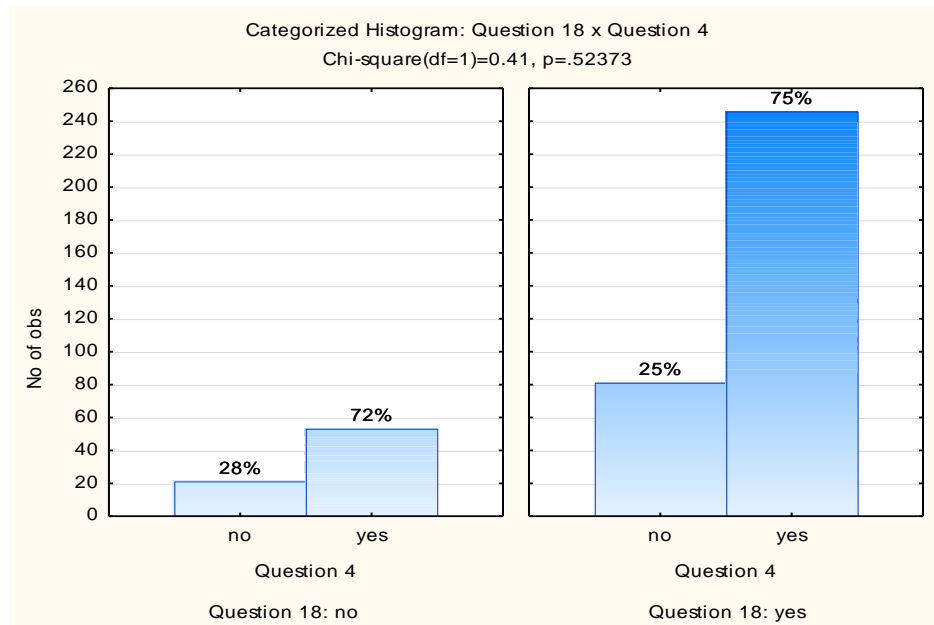


Figure 4.4.3.4: Caries prevalence associated with bottle-feeding practices [Question 4: Does the child have active caries? Question 18: Was/ is the child bottle-fed?]

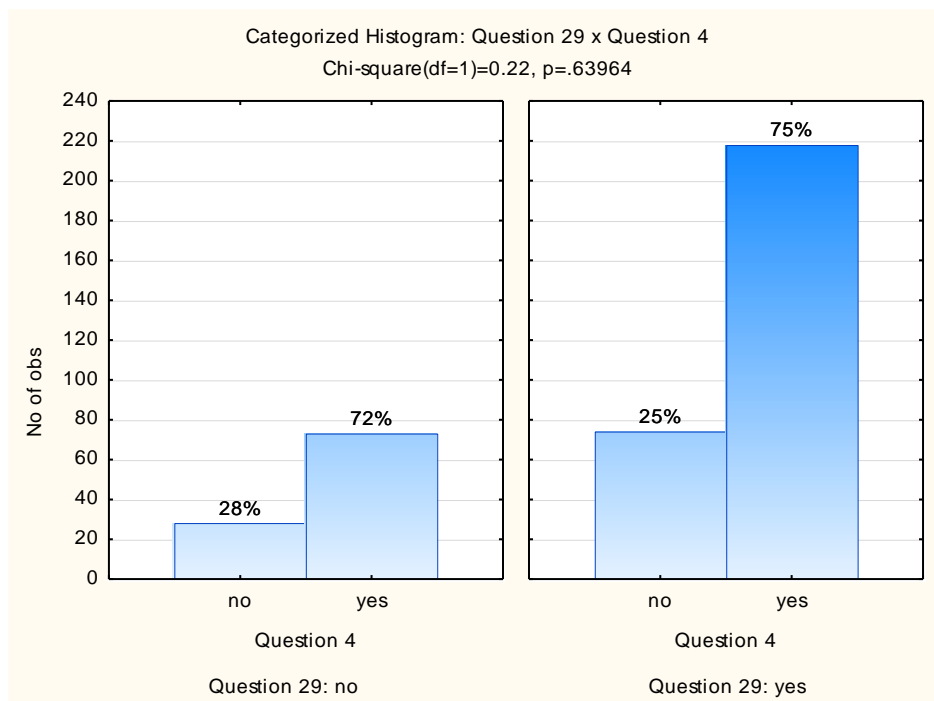


Figure 4.4.3.5: Caries prevalence associated with breastfeeding practices [Question 4: Does the child have active caries? Question 29: Was/ is the child breastfed?]

Parental age was not significantly associated with bottle-feeding (Mann-Whitney test, $p=0.74$) or breastfeeding practices (Mann-Whitney test, $p=1.00$).

Table 4.4.3.2: Parental age compared with bottle-feeding practices [Question 18: Was/ is the child bottle-fed? Question 46: What is the age of the parent?]

Cell No.	Question 18; LS Means (Spreadsheet2 in results.stw) Current effect: F(1, 391)=.11240, p=.73761 Effective hypothesis decomposition					
	Question 18	Question 46 Mean	Question 46 Std.Err.	Question 46 -95.00%	Question 46 +95.00%	N
1	no	29.1216	0.82727	27.4951	30.7480	74
2	yes	29.4294	0.39844	28.6461	30.2128	319

Table 4.4.3.3: Parental age compared with breastfeeding practices [Question 29: Was/ is the child breastfed? Question 46: What is the age of the parent?]

Effect	Descriptive Statistics (Spreadsheet2 in results.stw)						
	Level of Factor	N	Question 46 Mean	Question 46 Std.Dev.	Question 46 Std.Err	Question 46 -95.00%	Question 46 +95.00%
Total		388	29.3479	7.08713	0.35979	28.6405	30.0553
Question 29	no	97	29.3505	7.30445	0.74165	27.8783	30.8226
Question 29	yes	291	29.3470	7.02604	0.41187	28.5364	30.1577

4.4.4 Feeding times

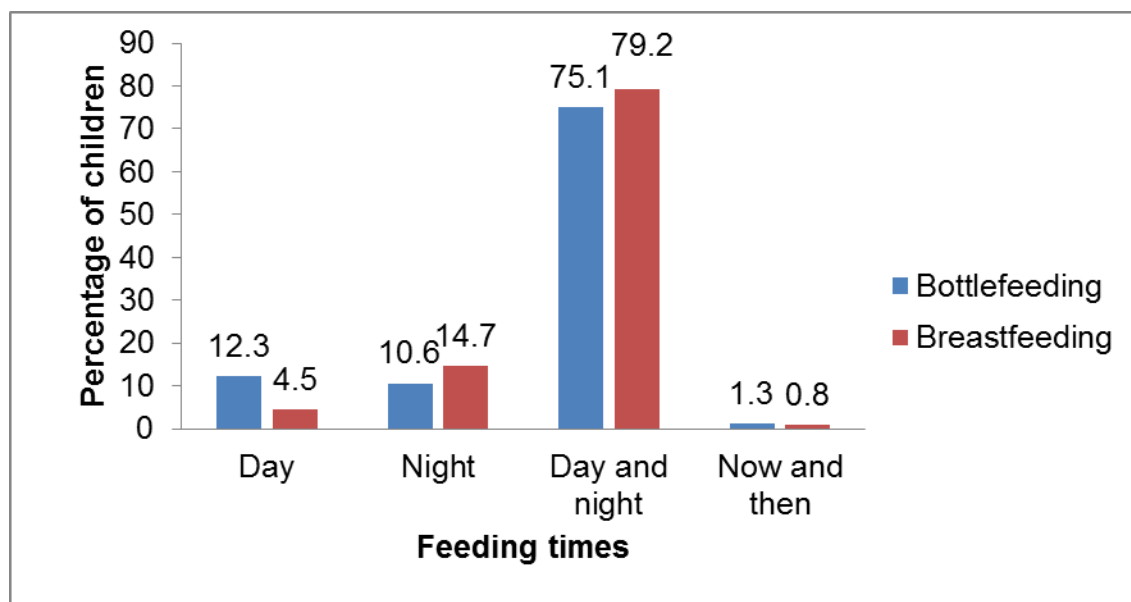


Figure 4.4.4.1: Feeding times

Parental age was also not significantly associated with the time of day that children were bottle-fed (Kruskal-Wallis test, $p=0.82$) or breastfed (Kruskal-Wallis test, $p=1.00$).

Table 4.4.4.1: Time of day that children were bottle-fed compared with parental age

[Question 23: When did/ does the child drink from the bottle? Question 46: What is the age of the parent?]

Question 23; LS Means (Spreadsheet2 in results.stw)						
Current effect: F(2, 311)=.20261, p=.81670						
Effective hypothesis decomposition						
Cell No.	Question 23	Question 46 Mean	Question 46 Std.Err.	Question 46 -95.00%	Question 46 +95.00%	N
1	During the da	30.1860	1.10972	28.0025	32.3695	43
2	At night	29.3125	1.28639	26.7813	31.8436	32
3	Day and night	29.4518	0.47070	28.5257	30.3780	239

Table 4.4.4.2: Time of day that children were breastfed compared with parental age

[Question 24: When did/ does the child drink from the breast? Question 46: What is the age of the parent?]

Question 24; LS Means (Spreadsheet2 in results.stw)						
Current effect: F(2, 285)=.00408, p=.99593						
Effective hypothesis decomposition						
Cell No.	Question 24	Question 46 Mean	Question 46 Std.Err.	Question 46 -95.00%	Question 46 +95.00%	N
1	During the da	29.1666	2.04039	25.1505	33.1828	12
2	At night	29.3720	1.07788	27.2504	31.4937	43
3	Day and night	29.3433	0.46305	28.4319	30.2547	233

There was also no significant association between the caries distribution pattern and the time of day when the bottle was drunk (Chi-square test, $p = 0.34$) or when breastfeeding took place (Chi-square test, $p = 0.20$).

Table 4.4.4.3: Time of day that children were bottle-fed compared with caries

distribution pattern [Question 5: What is the caries distribution pattern? [Question 23: When did/ does the child drink from the bottle?]

Marked cells have counts > 10. Chi-square(df=6)=6.81, p=.33					
Question 23: other	Question 5 s-ECC	Question 5 ECC	Question 5 s-ECC and ECC	Question 5 Caries free	Row Totals
During the day	12	6	16	9	43
Row Percen	27.91%	13.95%	37.21%	20.93%	
At night	7	3	18	6	34
Row Percen	20.59%	8.82%	52.94%	17.65%	
Day and night	72	11	114	49	246
Row Percen	29.27%	4.47%	46.34%	19.92%	
Totals	91	20	148	64	323

Table 4.4.4.4: Time of day that children were breastfed compared with caries distribution pattern [Question 5: What is the caries distribution pattern? Question 24: When did/does the child drink from the breast?]

Marked cells have counts > 10. Chi-square(df=6)=8.52, p=.20					
Question 24: other	Question 5 s-ECC	Question 5 ECC	Question 5 s-ECC and ECC	Question 5 Caries free	Row Totals
During the day	6	1	4	1	12
Row Percen	50.00%	8.33%	33.33%	8.33%	
At night	8	6	20	10	44
Row Percen	18.18%	13.64%	45.45%	22.73%	
Day and night	59	12	111	52	234
Row Percen	25.21%	5.13%	47.44%	22.22%	
Totals	73	19	135	63	290

4.4.5 Duration of feeding practices

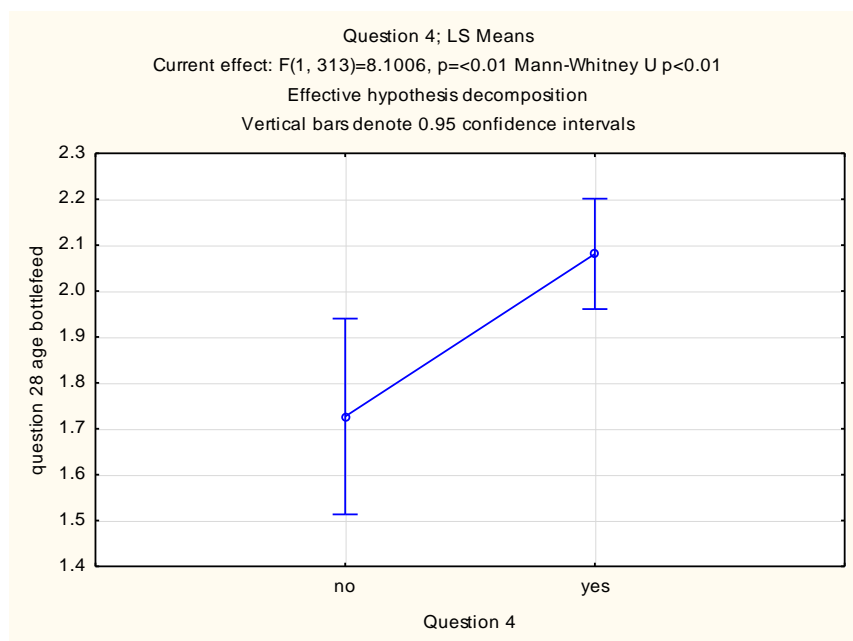


Figure 4.4.5.1.: Duration of bottle feeding and its association with caries prevalence [Question 4: Does the child have active caries? Question 28: At what age was the bottle was stopped?]

Table 4.4.5.1: Caries distribution and cessation of bottle-feeding

Age category	Caries distribution pattern		No of children who ceased bottle-feeding at this age	% of children who ceased bottle-feeding at this age (n= 301)
6 to 11 months	s-ECC	5	14	4.7
	ECC	2		
	Combination	5		
	Caries-free	2		
1 yr to 1yr 11 months	s-ECC	11	41	13.6
	ECC	4		
	Combination	16		
	Caries-free	10		
2 yrs to 2yrs 11 months	s-ECC	14	64	21.3
	ECC	4		
	Combination	40		
	Caries-free	6		
3 yrs to 3yrs 11 months	s-ECC	1	19	6.3
	ECC	0		
	Combination	18		
	Caries-free	0		
4 years	s-ECC	0	6	2.0
	ECC	1		
	Combination	5		
	Caries-free	0		
5 years	s-ECC	1	1	0.3
	ECC	0		
	Combination	0		
	Caries-free	0		
Few months	s-ECC	0	2	0.7
	ECC	0		
	Combination	1		
	Caries-free	1		
Don't know	s-ECC	1	9	3.0
	ECC	1		
	Combination	3		
	Caries-free	4		
TOTAL			156	51.8

Most of the children who had been bottle-fed, stopped drinking the bottle between 2 years and 2 years 11 months of age. Caries prevalence was not significantly associated with bottle-feeding (Chi-square test, $p = 0.52$).

Table 4.4.5.2: Caries distribution of those still bottle-feeding

Age category	Caries distribution pattern		No of children still bottle-feeding at this age	% of children still bottle-feeding at this age (n=301)
6 to 11 months	s-ECC	0	4	1.3
	ECC	0		
	Combination	0		
	Caries-free	4		
1 yr to 1yr 11 months	s-ECC	35	69	22.9
	ECC	3		
	Combination	4		
	Caries-free	27		
2 yrs to 2yrs 11 months	s-ECC	16	47	15.6
	ECC	2		
	Combination	19		
	Caries-free	10		
3 yrs to 3yrs 11 months	s-ECC	4	15	5.0
	ECC	1		
	Combination	10		
	Caries-free	0		
4 years	s-ECC	4	10	3.3
	ECC	0		
	Combination	4		
	Caries-free	2		
TOTAL			145	48.2

Of the children who were still bottle-feeding at the time of examination, only 27 were caries-free in the 1 year to 1 year 11 month age group. In total, 80.4% (242/ 301) of parents continued to bottle-feed their children past the age of 1 year 11 months of age. Duration of bottle-feeding was significantly associated with caries prevalence (Mann-Whitney test, $p < 0.01$).

Table 4.4.5.3: Caries distribution of those who ceased breastfeeding

Age category	Caries distribution pattern		No of children who ceased breastfeeding at this age	% of children who ceased breastfeeding at this age (n=264)
0 to 11 months	s-ECC	27	85	32.2
	ECC	4		
	Combination	33		
	Caries-free	21		
1 yr to 1yr 11 months	s-ECC	9	25	9.5
	ECC	1		
	Combination	11		
	Caries-free	4		
2 yrs to 2yrs 11 months	s-ECC	4	29	11.0
	ECC	3		
	Combination	19		
	Caries-free	3		
3 yrs to 3yrs 11 months	s-ECC	3	17	6.4
	ECC	1		
	Combination	11		
	Caries-free	2		
4 yrs to 4yrs 11 months	s-ECC	1	6	2.3
	ECC	3		
	Combination	0		
	Caries-free	2		
Few days	s-ECC	2	7	2.7
	ECC	0		
	Combination	2		
	Caries-free	3		
Few weeks	s-ECC	2	7	2.7
	ECC	0		
	Combination	4		
	Caries-free	1		
Few months	s-ECC	3	6	2.3
	ECC	0		
	Combination	1		
	Caries-free	2		
Don't know	s-ECC	0	6	2.3
	ECC	2		
	Combination	4		
	Caries-free	0		
TOTAL			188	71.2

Most children were weaned off the breast before the age of 1 year. Breastfeeding practices did not show an association with caries prevalence (Chi-square test, $p = 0.64$).

Table 4.4.5.4: Caries distribution of those who were still breastfeeding

Age category	Caries distribution pattern		No of children still breastfeeding at this age	% of children still breastfeeding at this age (n=264)
0 to 11 months	s-ECC	0	3	1.1
	ECC	0		
	Combination	0		
	Caries-free	3		
1 yr to 1yr 11 months	s-ECC	12	26	9.8
	ECC	1		
	Combination	1		
	Caries-free	12		
2 yrs to 2yrs 11 months	s-ECC	6	20	7.5
	ECC	1		
	Combination	6		
	Caries-free	7		
3 yrs to 3yrs 11 months	s-ECC	3	16	6.1
	ECC	1		
	Combination	9		
	Caries-free	3		
4 yrs to 4yrs 11 months	s-ECC	2	8	3.0
	ECC	0		
	Combination	5		
	Caries-free	1		
5 years	s-ECC	0	3	1.1
	ECC	0		
	Combination	3		
	Caries-free	0		
TOTAL			76	28.8

Duration of breastfeeding did not show a significant association with caries prevalence (Mann-Whitney test, $p = 0.32$).

4.4.6 Behaviour control

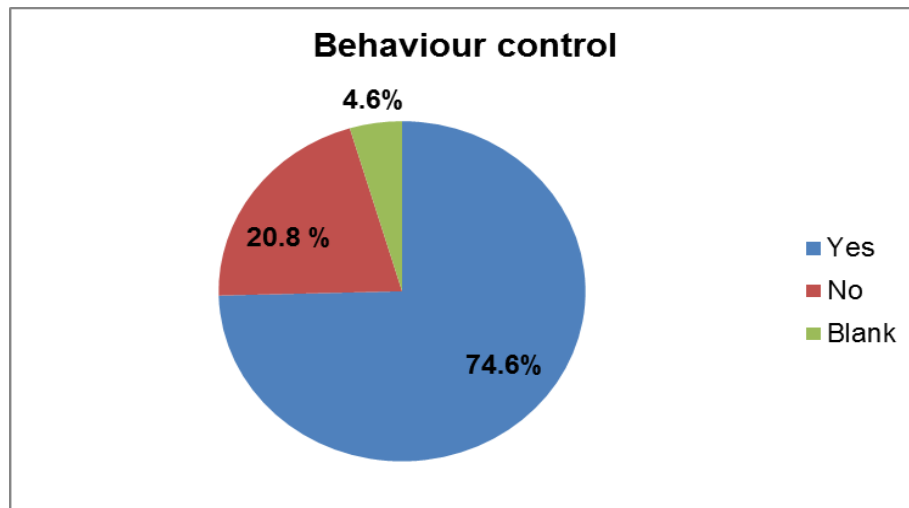


Figure 4.4.6.1: Bottle used as a means of behaviour control

Two hundred and seventy-three parents (74.6%) admitted that they used the bottle as a means to control their child's behaviour.

4.4.7 Contents of the bottle

Of the 301 children who drank from the bottle, only 2 caregivers were unsure as to the contents of the bottle.

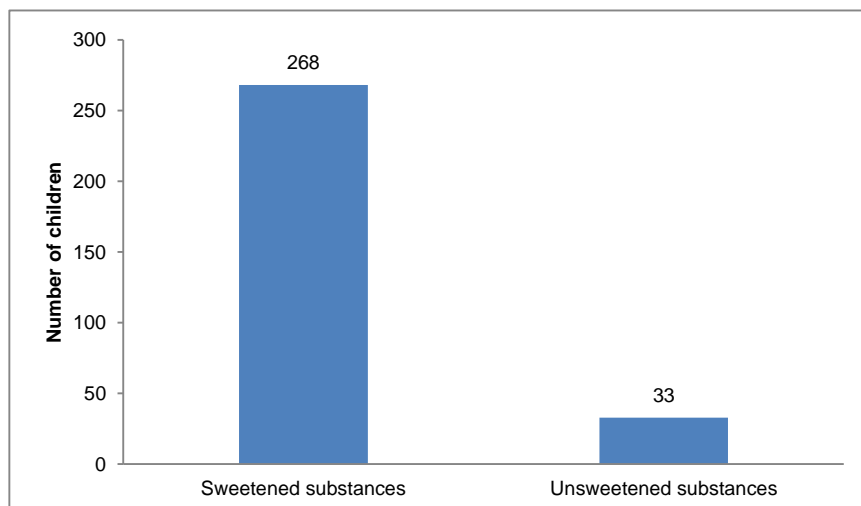


Figure 4.4.71: Types of substances consumed from the bottle

The number of times various sweetened substances were consumed is depicted in Table 4.4.7.1. One hundred and forty children received a combination of two or more sweetened substances from the bottle.

Table 4.4.7.1: Sweetened substances consumed from the bottle

Sweetened substances	Number of times the substance was reported (n=433)
Coke®/ carbonated cooldrinks	20
Sweetened formula	2
Juice/ Purity® juice	132
Sweetened milk	35
Milkshake	3
Milo®	1
Nesquick®	7
Sugar water	10
Glucose	1
Rooibos tea (normal) with sugar	82
Rooibos tea (kids) with sugar	4
Other tea with sugar-- unspecified	129
Other sweetened substances	7

Only 33/ 301 (11%) bottle-fed children exclusively drank unsweetened substances from the bottle. The rest of the children received sweetened and unsweetened beverages at one time or another. A breakdown of the number of times unsweetened substances were consumed from the bottle is reflected in Figure 4.4.7.2. Eight children received a combination of two or more unsweetened substances from the bottle.

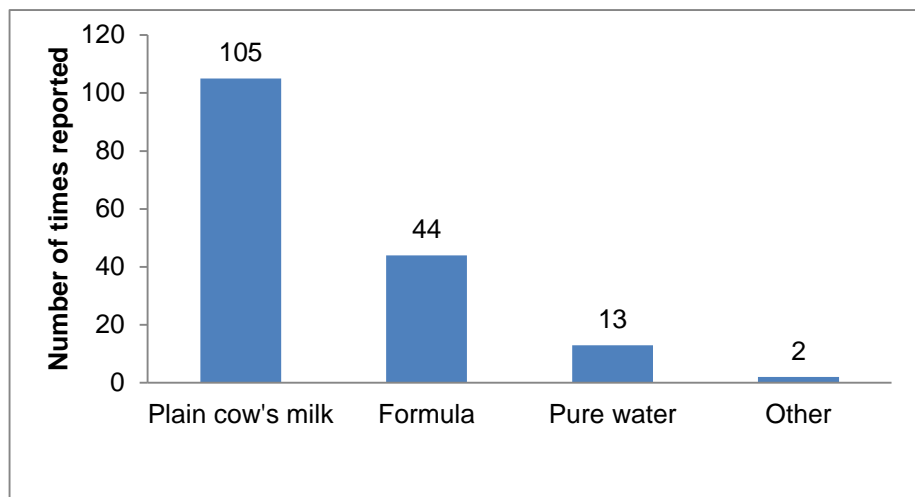


Figure 4.4.7.2: Unsweetened substances consumed from the bottle

Unsweetened cow's milk drunk from the bottle was not significantly associated with the caries distribution pattern (Chi-square test, $p=0.22$).

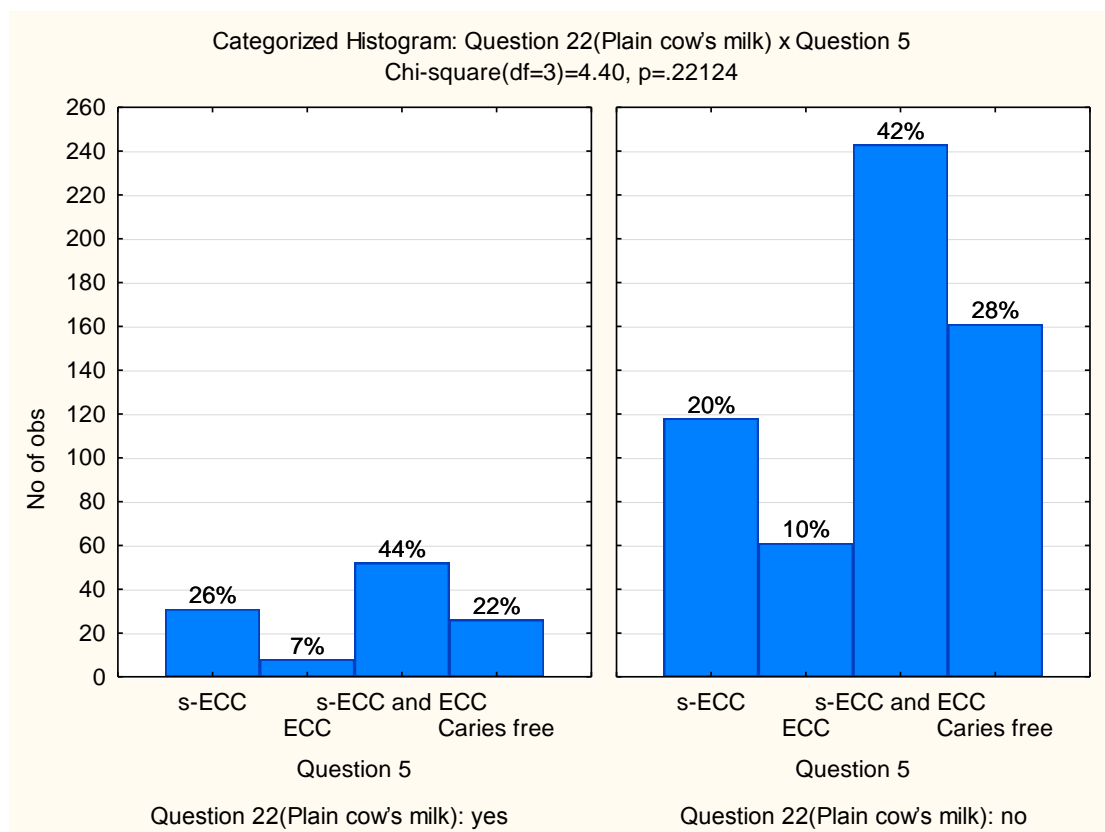


Figure 4.4.7.3: Unsweetened cow's milk and its association with caries distribution pattern [Question 5: What is the caries distribution pattern? Question 22: What types of unsweetened substances are/ were drunk from the bottle?]

4.4.8 Diet and consumption of sweet foods

The frequency of sweet food consumption as reported by the parents is reflected in Table 4.4.8.1.

Table 4.4.8.1: Sweet food consumption

Frequency	Number of children	%	Number of children with caries in each category
Once a day	105	28.7	84
Two or more times a day	133	36.3	107
Infrequently (few times a week)	81	22.1	59
Never	41	11.2	15
Don't know	6	1.7	2
TOTAL	366	100.0	267

A significant association was found between caries prevalence and sweet food consumption (Chi square test, $p = 0.00001$).

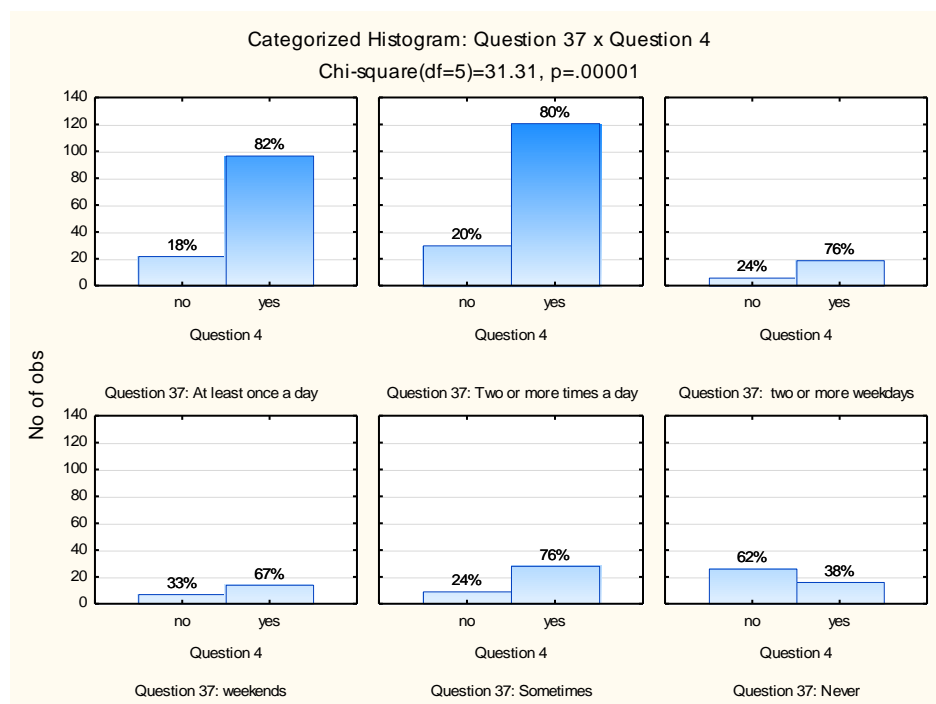


Figure 4.4.8.1.: Sweet food consumption and its association with caries prevalence Question 4: Does the child have active caries?
Question 37: What is the frequency of sweet food consumption?

4.4.9 Oral hygiene practices

Nearly 95% of caregivers (346/ 366) never received professional advice regarding oral hygiene practices.

Table 4.4.9.1: Ages for the introduction of oral hygiene practices where age was reported*

Age	Number of children	%
3 mnths to 11 months	21	7.4
1year to 1 yr 11mnths	117	41.5
2years to 2yrs 11 months	77	27.3
3years	37	13.1
4years	8	2.8
5 years	2	0.7
Since birth	1	0.4
Few months old	1	0.4
As soon as teeth erupted	18	6.4
TOTAL	282	100.0

*For 84 of the children, the caregiver could not provide an age at which oral hygiene was introduced.

Only 94 parents indicated that their child's teeth were cleaned after feeding. This is to be distinguished from the daily oral hygiene practices where the children's teeth are brushed at other times of the day and not necessarily after feeds. Oral hygiene practices after feeding is summed up in Figure 4.4.9.1 and Table 4.4.9.2.

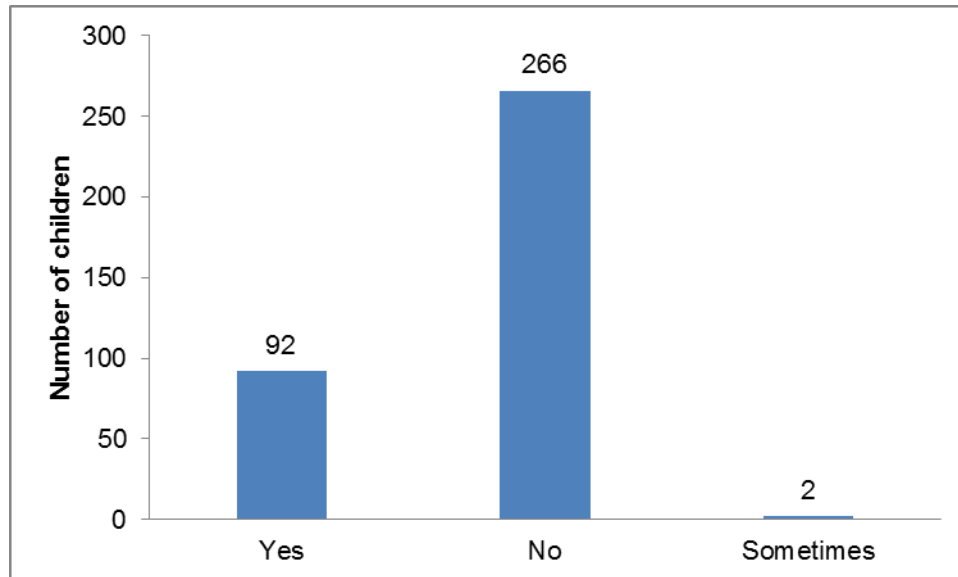


Figure 4.4.9.1: Oral hygiene practices instituted after feeding

Table 4.4.9.2.: Method of oral hygiene instituted after feeding

Cleaning method	Number of children
Damp cloth	5
Rinsing/ drinking water	3
Salt water	2
Glycerine	11
Unspecified method	73

A significant association was found between caries distribution pattern and oral hygiene practices instituted after feeding (Chi-square test, $p = 0.002$).

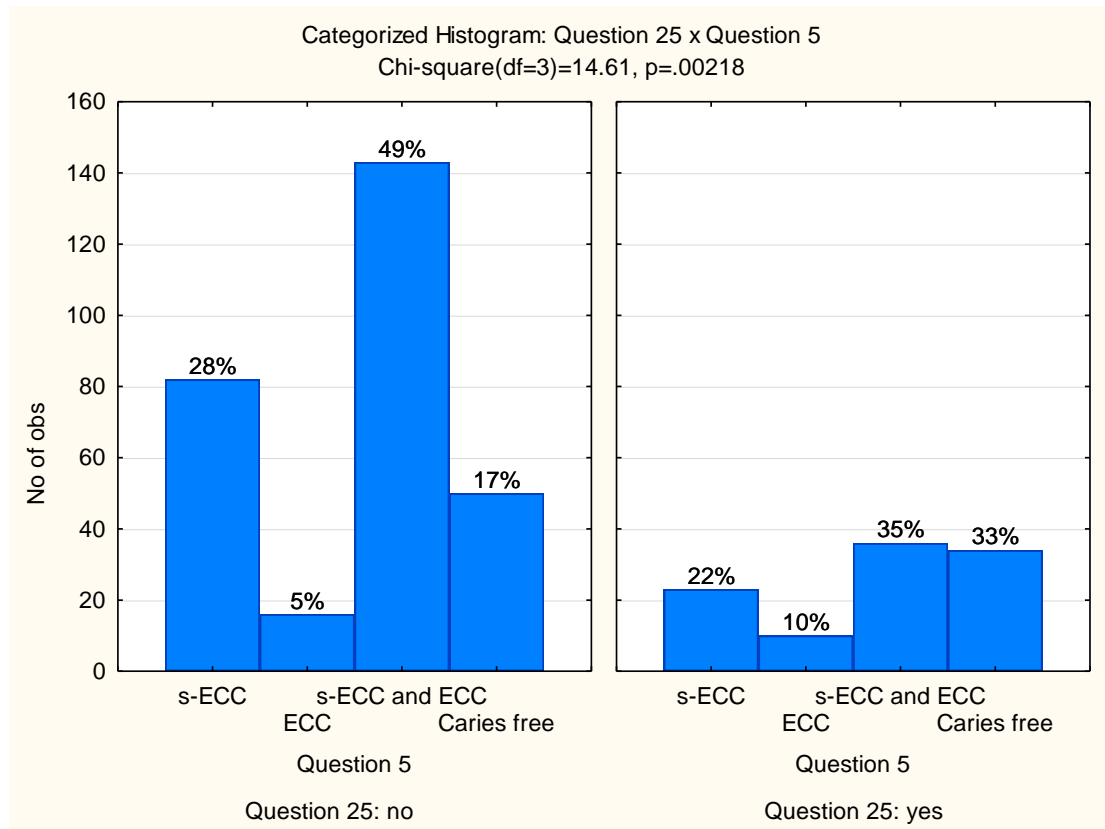


Figure 4.4.9.2.: Oral hygiene practices instituted after feeding and the association with caries distribution pattern [Question 5: What is the caries distribution pattern? Question 25: Are the child's teeth cleaned after feeding?]

Where daily oral hygiene measures were concerned, a total of 319 children practised some form of oral hygiene. One-hundred-and-thirty-two of the 366 (36.1%) children were responsible for their own oral hygiene (See Figure 4.4.9.3).

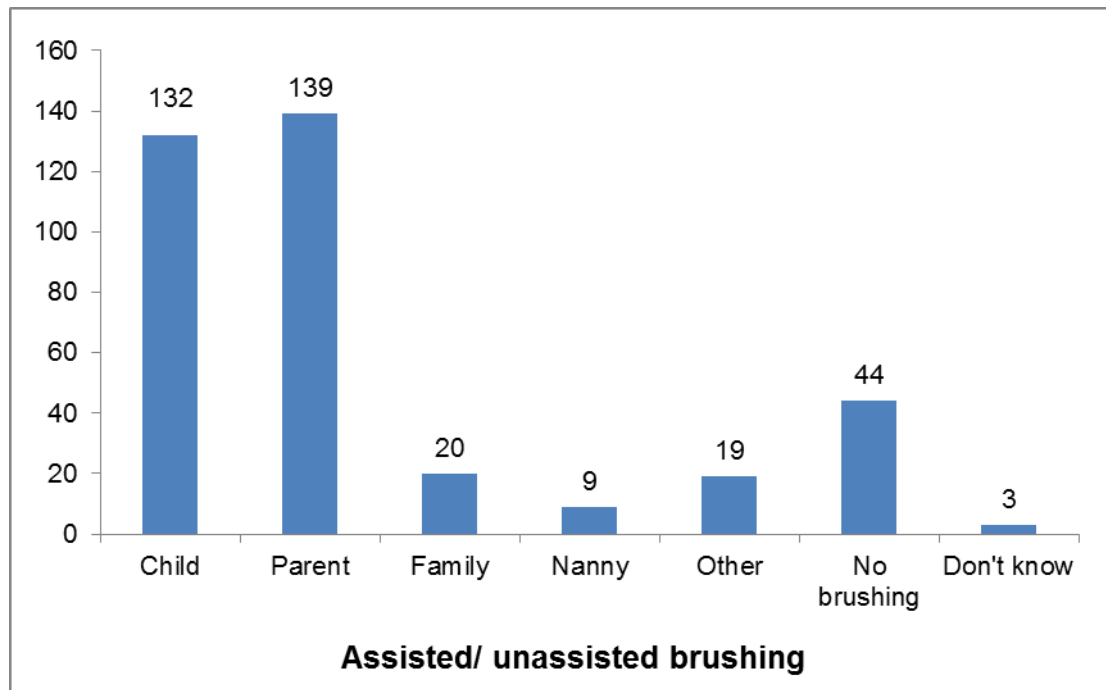


Figure 4.4.9.3: Daily oral hygiene practices: Assisted vs unassisted brushing (number of observations)

Forty-four children had never had their teeth cleaned. Nearly 59% (187) had some form of assistance with brushing. The age distribution of these children who brushed their own teeth is summarized in Table 4.4.9.3.

Table 4.4.9.3: Age distribution of children who brushed their teeth on their own without assistance.

Age	Number of children (n=132)	%
1 yr to 1 yr 11 months	10	7.6
2 yrs to 2 yrs 11 months	21	16.0
3 yrs to 3 yrs 11 months	33	25.0
4 years	34	25.7
5 years	34	25.7

Children who brushed their own teeth had a significantly higher caries prevalence (Chi-square test, $p = 0.000$).

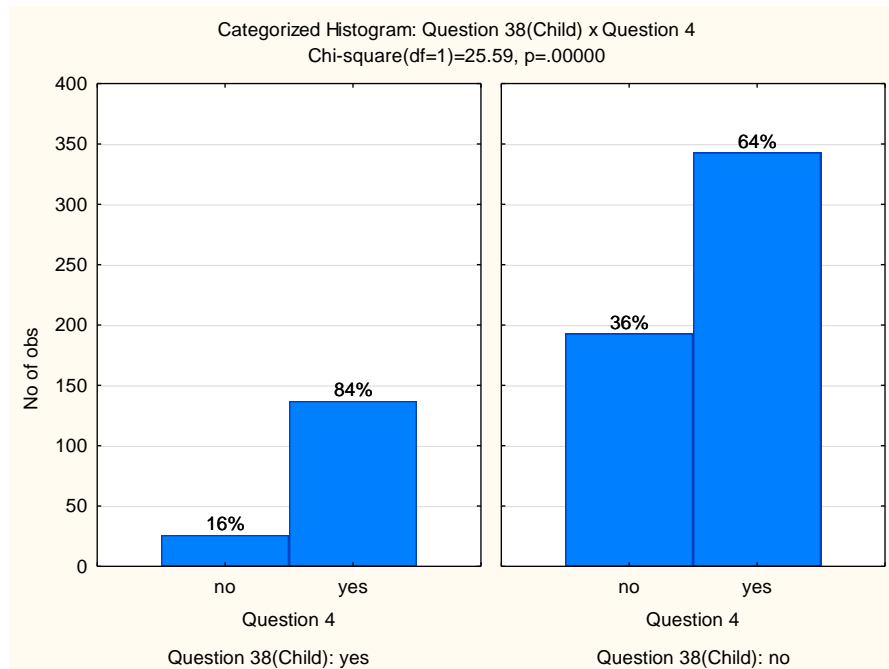


Figure 4.4.9.4: Association between unassisted brushing and caries prevalence [Qu 4: Does the child have active caries? Qu 38: Who brushes the child's teeth (child brushes his/ her own teeth)]

Increasing parental age was significantly associated with more unassisted brushing (Mann-Whitney test, $p < 0.01$).

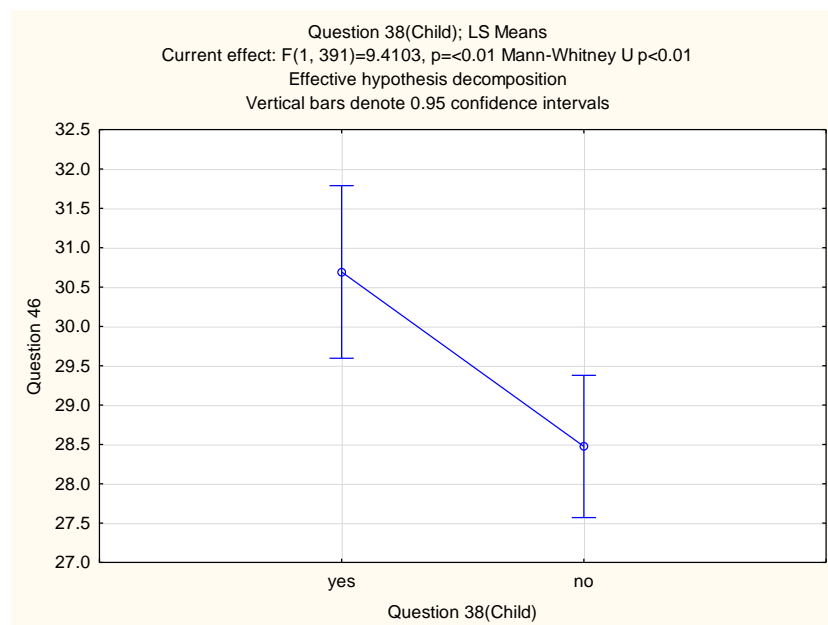


Figure 4.4.9.5: Parental age and its association with unassisted brushing [Qu 38: Who brushes the child's teeth (child brushes his/ her own teeth) Qu 46: What is the age of the parent?]

Parental education level on the other hand was not associated with unassisted brushing (Chi-square test, $p = 0.27$).

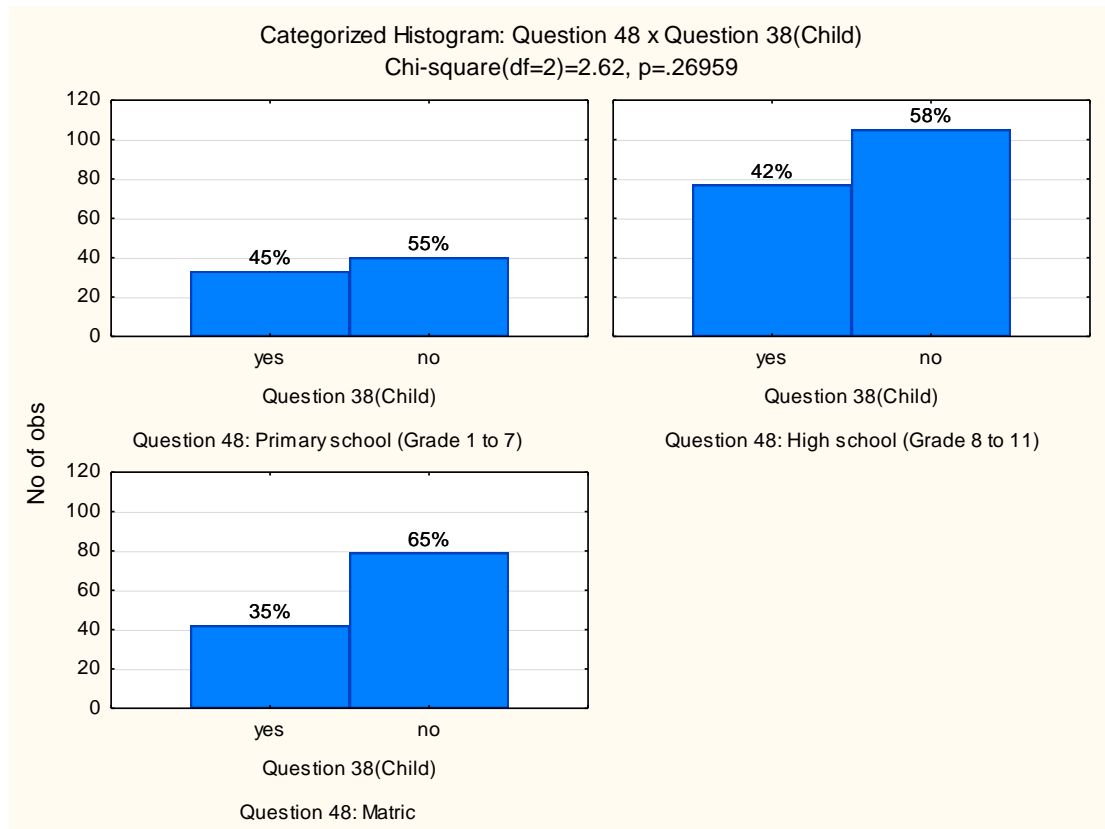


Figure 4.4.9.6: Parental education level and its association with unassisted brushing [Qu 38: Who brushes the child's teeth (child brushes his/ her own teeth) Qu 48: What is the parental level of education?]

Table 4.4.9.4: Daily oral hygiene regimen of children who practised some form of oral hygiene

Method of oral hygiene	Number = 319	%
Toothbrush with toothpaste	298	93.4
Toothbrush only	4	1.3
Damp cloth	16	5.0
Glycerine	1	0.3
TOTAL	319	100.0

Children who used a toothbrush and toothpaste to clean their teeth had a significantly lower caries prevalence (Chi-square test, $p=0.000$). Of the 298 children who used toothpaste, 6 caregivers were unsure as to the type of toothpaste that was used.

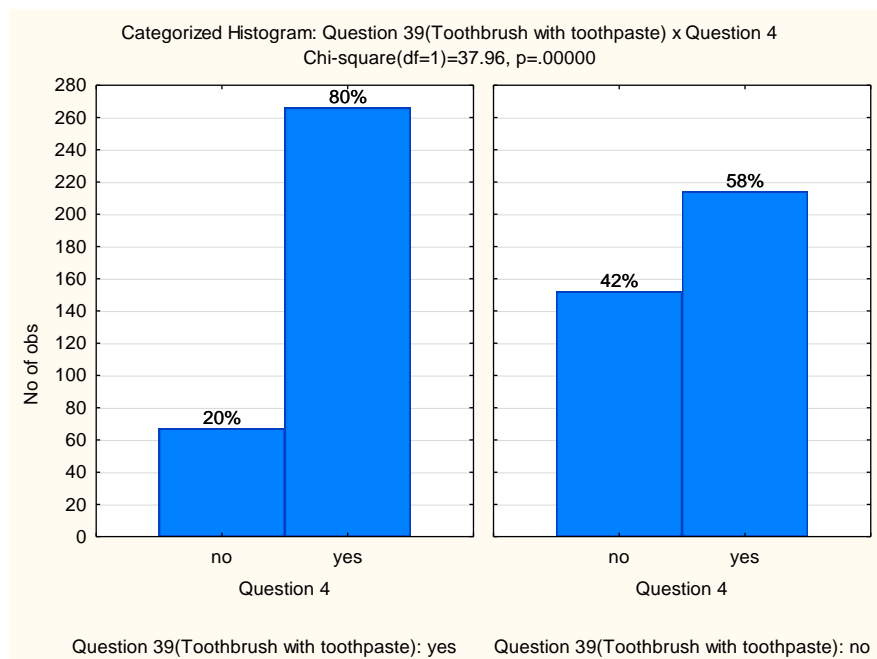


Figure 4.4.9.7: Association between caries prevalence and the use of toothbrush and toothpaste [Question 4: Does the child have active caries? Question 39: What is used to clean the child's teeth? (Toothbrush with toothpaste)]

4.4.10 Type of toothpaste

Table 4.4.10.1: Type of toothpaste reported by caregivers whose children used toothpaste

Type of toothpaste	Number of children	%
Kid's fluoridated toothpaste (brand known)	141	48.3
Kid's toothpaste (brand unknown)	34	11.6
Adult fluoridated toothpaste (brand known)	112	38.4
Adult toothpaste (brand unknown)	5	1.7
TOTAL	292	100.0

More than 80% of children brushed their teeth with fluoridated toothpaste. Of these, 40% of them used adult brands.

Table 4.4.10.2: Most common toothpaste brands

Common toothpaste brands	Number	%
Aquafresh® adult	30	10.3
Aquafresh® kids	61	20.9
Aquafresh® Milk teeth	9	3.1
Bambino®	17	5.8
Colgate® adult	76	26.0
Colgate® kids	53	18.2
Colgate® Herbal	5	1.7
Colgate® Whitening	1	0.3
Mentadent® kids	1	0.3
Unknown brands	39	13.4
TOTAL	292	100.0

4.4.11 Brushing frequency

Seven caregivers were unable to provide information about the frequency of the child's oral hygiene regimen. For the remaining 359 children, the frequency of their oral hygiene practices are reflected in Figure 4.4.11.1.

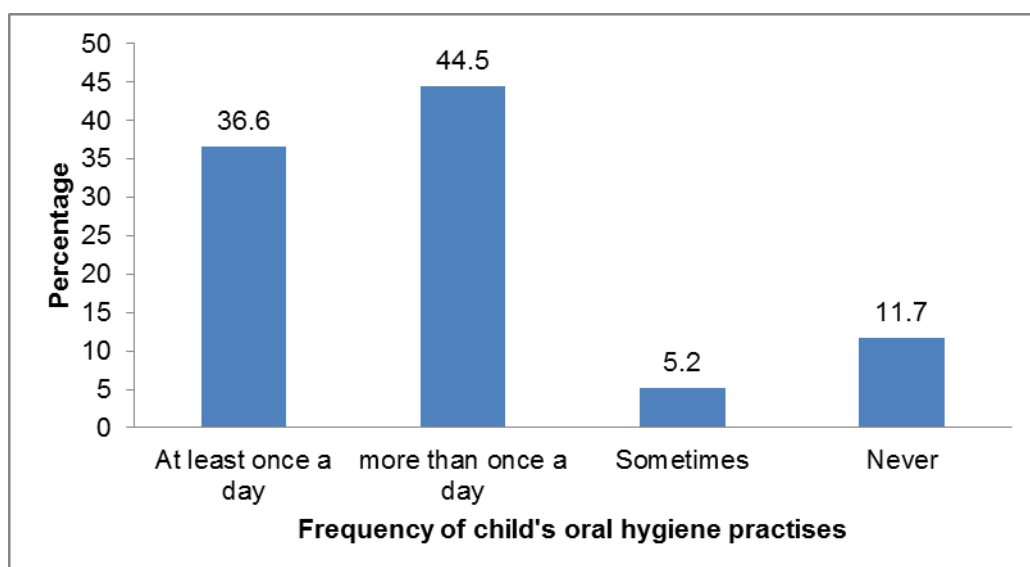


Figure 4.4.11.1: Frequency of oral hygiene practices

A significant inverse association was demonstrated between frequency of brushing and caries prevalence (Chi-square test, $p=0.007$).

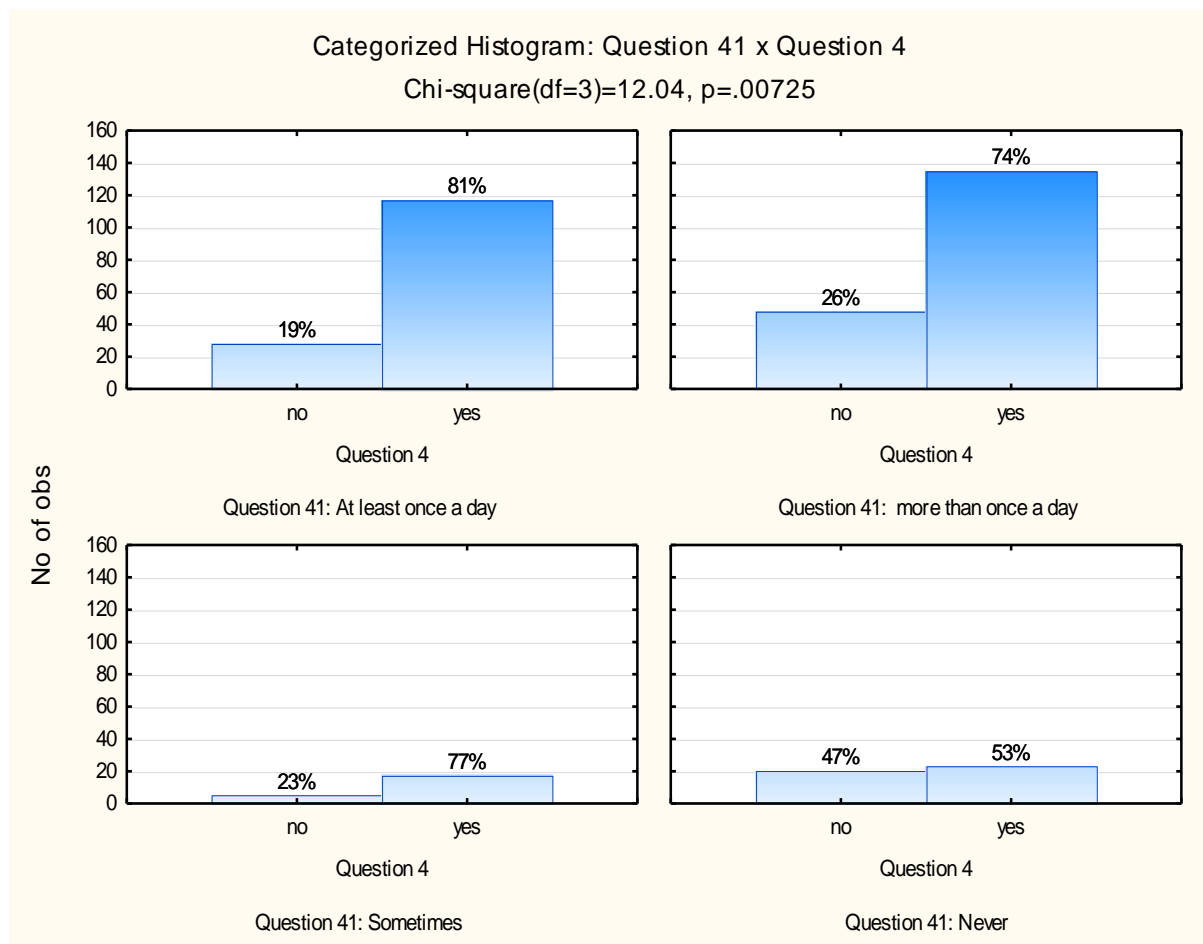


Figure 4.4.11.2: Frequency of brushing compared with caries prevalence [Question 4: Does the child have active caries? Question 41: How often are the child's teeth cleaned?]

4.4.12 Dental history

Of the 366 children for whom interviews were conducted with their caregivers, only 63 of them had previously been to a dentist for treatment. The regularity of dental visits is illustrated in Figure 4.4.12.1.

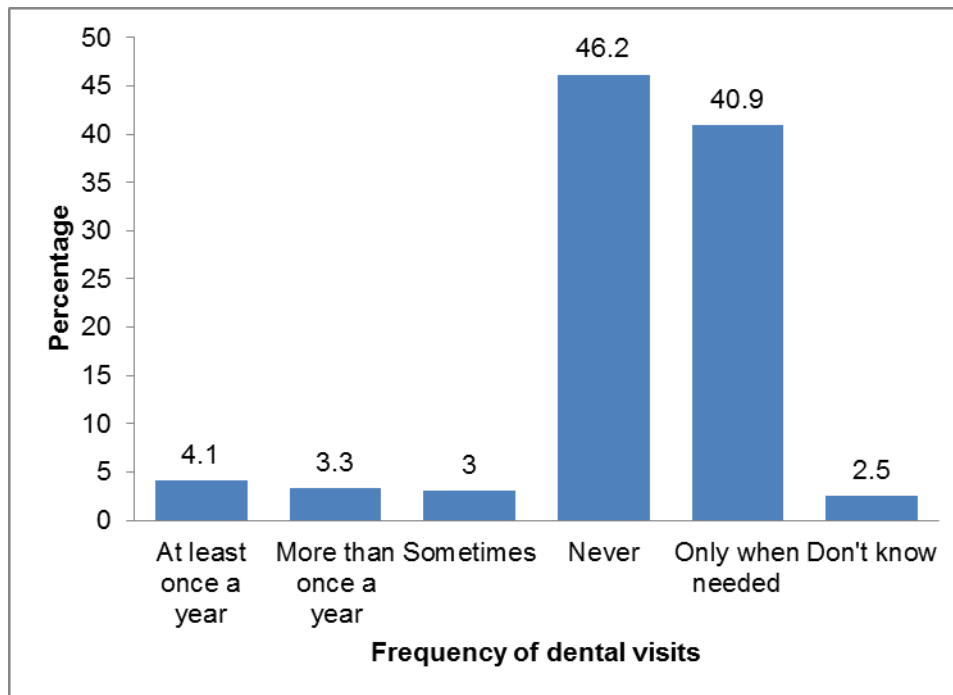


Figure 4.4.12.1: Frequency of dental visits for families interviewed

The vast majority i.e. 82.8% (303) had no previous exposure to dental treatment of any kind. No significant association was found between the frequency of dental visits and caries prevalence (Chi-square test, $p=0.86$).

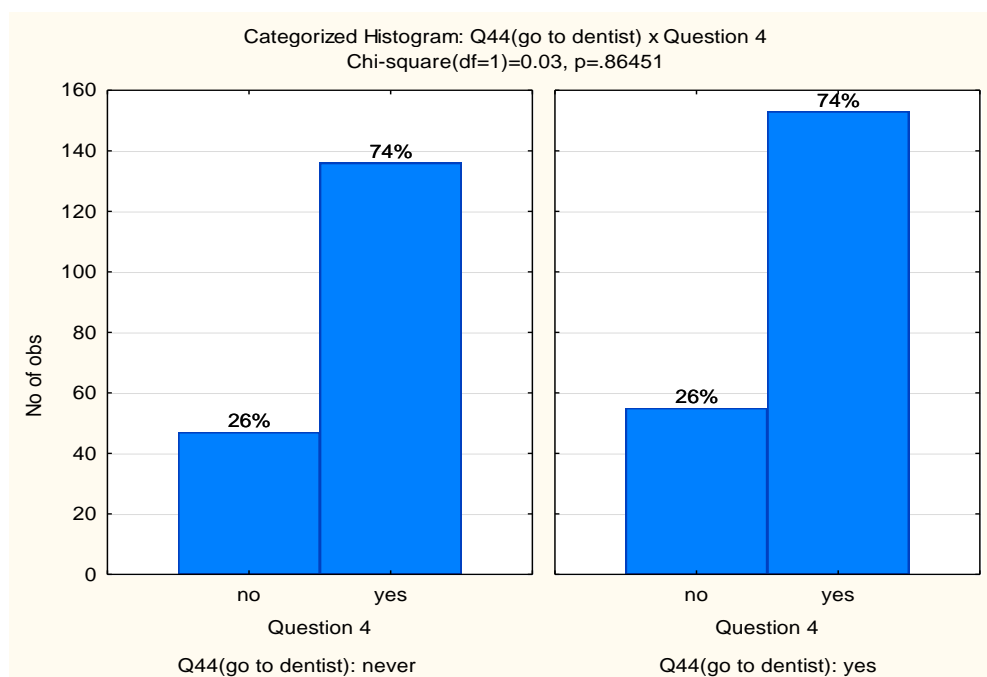


Figure 4.4.12.2: Frequency of dental visits compared with caries prevalence [Question 4: Does the child have active caries? Question 44: How often does the child/ child's family visit the dentist?]

Sixty-three children were accompanied by their parents but only 58 parents were able to provide a specific age at which the child first received dental treatment. For those children who had been to a dentist before, the age of their first dental visit is reflected in Table 4.4.12.1.

Table 4.4.12.1: Age of first dental visit for those children where a specific dental age was provided

Age	Number of children (n=58)	%
1year to 1yr 11 months	5	8.6
2 years to 2yrs 11 months	19	32.8
3 years	16	27.6
4 years	14	24.1
5 years	4	6.9
TOTAL	58	100.0

Fifty-seven of the 58 children who received dental treatment had extractions done. A breakdown of the type of treatment carried out on these children is reflected in Figure 4.4.12.3.

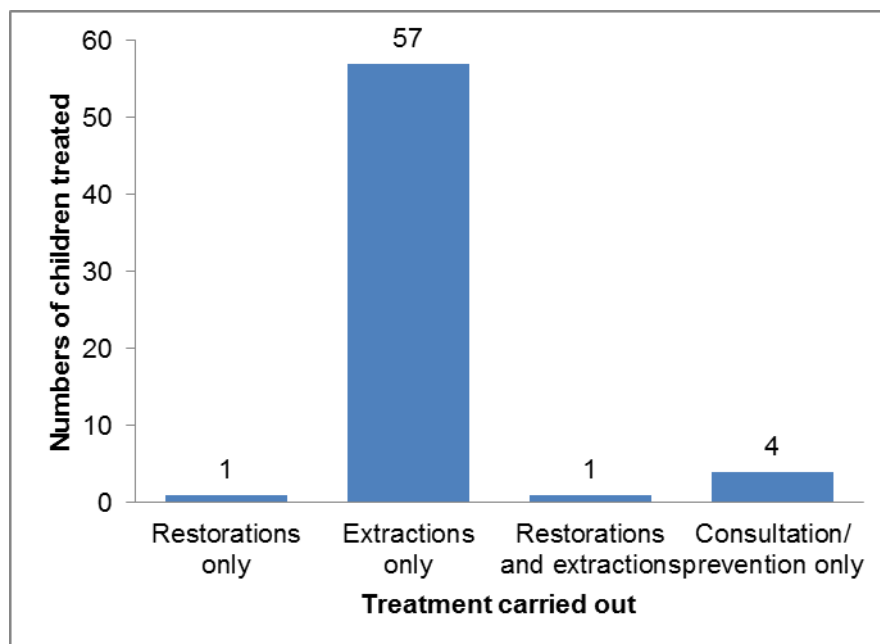


Figure 4.4.12.3: Treatment carried out

Parents/ caregivers were generally ill-informed about the benefits of saving their children's deciduous teeth. Approximately half those (48% 1.e.176/ 366) indicated that they would have their children's teeth restored. Eighteen of the 366 caregivers did not know what fillings/ restorations were.

4.4.13 General health of the child

Of the children examined, only 24 of them (6.5%) had medical conditions that affected their general health and well-being. Additional conditions were reported in 38 children and these cases comprised approximately 10% of all children for whom parental interviews were conducted. These conditions are listed in Table 4.4.13.1 with asthma being reported in 3.3% of all children examined. The rest all appeared healthy and this was confirmed by their caregivers.

Table 4.4.13.1: Additional conditions reported

Condition	Number	%
Anaemia	2	5.3
Asthma	12	31.6
Cardiac condition	4	10.5
Trisomy 21 (Down's Syndrome)	1	2.6
Cleft palate	1	2.6
Eczema	5	13.1
Epilepsy	2	5.3
Tonsillitis	1	2.6
Respiratory problems	2	5.3
HIV	1	2.6
TB	3	7.9
TB meningitis	2	5.3
Other conditions	2	5.3
TOTAL	38	100.0

Three-hundred-and-twenty-one children (87.7%) were full-term babies and only 5 caregivers were unsure if the child had been born prematurely. Birth complications were only reported in 12 cases. Four babies were born by caesarian section.

No significant association between caries distribution pattern and prematurity was demonstrated (Chi-square test, $p=0.27$).

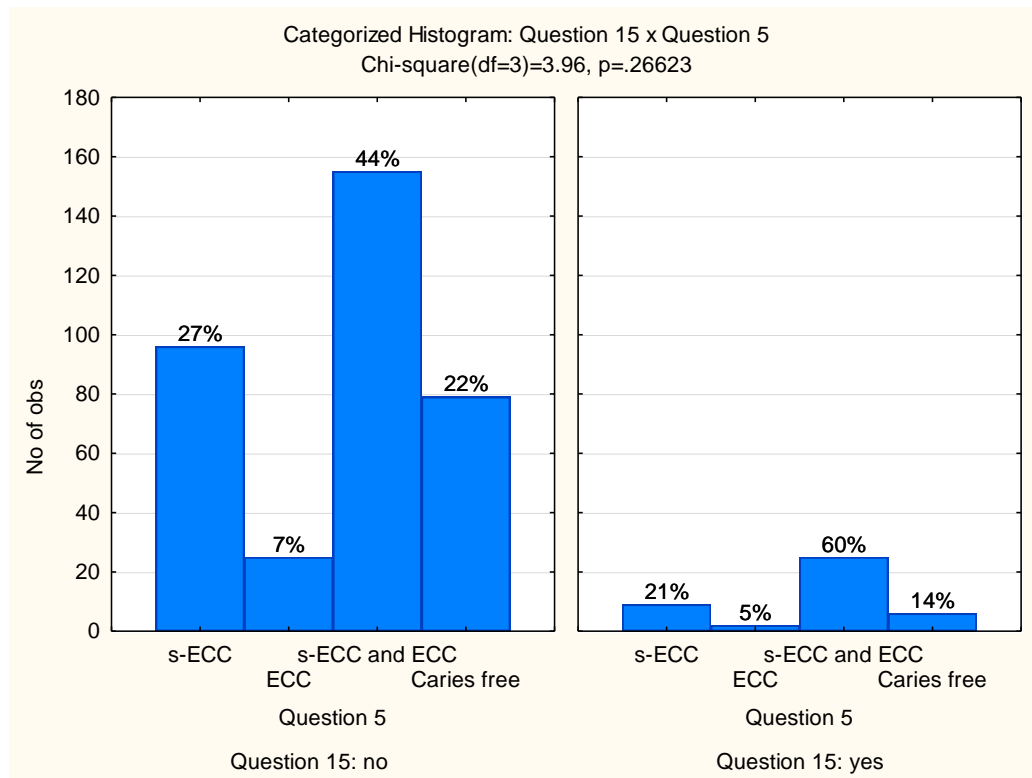


Figure 4.4.13.1: Association between caries distribution pattern and prematurity [Question 5: What is the caries distribution pattern? Question 15: Was the child born prematurely?]

4.5 Discussion

It is clear from the responses to the questions posed to the group of caregivers who presented at the clinics that they were generally ill-informed regarding dental health. Their lack of knowledge manifested as poor oral health behaviour in terms of oral hygiene and feeding practices. This in turn was associated with poor oral health and high caries prevalence in their children.

4.5.1 Social history

4.5.1.1. CAREGIVER PROFILE

After the mothers, grandmothers and aunts made up the second and third largest groups of accompanying adults respectively (See Figure 4.4.2.8). Fathers only accompanied 15 children. Caregivers ranged in age from 15 years to above 50 years with a quarter of them ranging between 20 and 24 years of age (Table 4.4.2.1) while more than half of the caregivers (54.4%) were below the age of 30 years. No significant association between parental age and caries prevalence in their children was demonstrated (Refer to Table 4.4.2.2).

This finding is in contrast to other reported studies. Younger parents in Finland and Japan were shown to be more likely to have children who present with ECC (Mattila et al, 2000; Niji et al, 2010). Maternal age of between 17 and 22 years was a significant risk factor for caries development in Japanese children with children of these mothers having the highest caries prevalence (Niji et al, 2010). Children of young Finnish mothers were also more caries prone (Matilla et al, 2000). It is postulated that young mothers are more likely to be inexperienced or ill-equipped to deal with difficult children. This means that they may give in to their children's demands by placating them with unhealthy foods, thereby exacerbating the caries problem (Mattila et al, 2000).

On the other hand, a Nigerian study found that the children of older mothers were more caries prone (Adeniyi et al, 2009). This finding however needs to be interpreted with caution as the authors are unclear as to the reason for this and speculated that it could possibly be due to the fact that 'many of the older mothers resided in urban areas where refined carbohydrates were more readily available' (Adeniyi et al, 2009, p.453). No mention is made of the number of children these mothers had. Older mothers would be more likely have more children, which would also impact on the attention and amount of quality time that each child is able to receive. These confounding factors could therefore also have played a role.

4.5.1.2. PARENTAL/ CAREGIVER KNOWLEDGE

An overwhelming 77.3% of caregivers in the present study did not know what causes caries and they did not know that bottle- and/ or breastfeeding at bedtime without brushing their child's teeth afterwards could cause cavities. They were also unaware of the infectious nature of caries and that it can be transmitted through the saliva. In the present study,

parents whose children did not present with s-ECC were more aware of the infectious nature of the disease.

Children who play together and caregivers who are in close contact with children could also be a potential source of the *Streptococcus mutans* which can be transmitted between these individuals. A study amongst preschool children under the age of 6 years in Kosovo demonstrated that 93% of the children with ECC had high oral *Streptococcus mutans* counts (Begzati et al, 2010). Parents therefore need to be made aware that high risk behaviours like sharing the same utensils could make their child more prone to caries development and that earlier colonization of mutans streptococci is associated with more severe forms of the disease (Barsamian-Wunsch et al, 2004).

It has been shown that preventive measures which reduce the salivary mutans streptococci levels in mothers, especially at the time of their children's teething, can delay the development of caries in their children (Slayton, 2011). The oral health status of the primary parental caregiver is therefore very important and should be given the attention it deserves. Parental knowledge and attitude towards dental care needs to improve in order to make an impact on the dental health and caries status of the next generation.

4.5.1.3. PARENTAL EDUCATION AND SOCIO-ECONOMIC CIRCUMSTANCES

Less than a third of parents (113 i.e. 30.9%) completed high school and only 3 obtained an additional qualification after high school (Figure 4.4.2.1). Parental education was however not significantly associated with caries prevalence in their children (Figure 4.4.2.2).

Parental education level can be an indicator of socio-economic status or standard of living. Socio-economic status can be defined as a combination of number of years of education, current income and present occupation (Burt, 2005). Increased caries prevalence has been linked to lack of parental education (Chu, 2006; Canseco et al, 2011; Prakash et al, 2012). In a random sample of 1500 children between the ages of 8 months and 4 years of age in Bangalore, India, a strong association was demonstrated between maternal education level and caries experience in their children (Prakash et al, 2012).

In an Iranian study, a higher maternal level of education was associated with increased brushing frequency but even amongst the more highly educated parents, 59% claimed not to know how to clean their children's teeth (Mohebbi et al, 2008). This percentage rose to 73% amongst mothers with lower levels of education (Mohebbi et al, 2008).

In a Mexican study, ECC prevalence was higher among the children of less educated parents (Canseco et al, 2011). More teeth were affected by ECC in children whose mothers were housewives than in those whose mothers had a technical occupation (Canseco et al, 2011). Interestingly, in Brazil, the father's education level seemed to be a better predictor of children's health than maternal education level (Peres et al, 2005). The father's level of education was inversely associated with caries development. Children of self-employed and unemployed fathers with less than 8 years of education displayed a higher caries risk (Peres et al, 2005). It was thought that this could be due to the fact that fewer females were employed and that the culture also placed importance on men being the head of the household (Peres et al, 2005). In other studies, higher education levels were significantly associated with reduced caries prevalence (Livny et al, 2007; Schroth et al, 2010).

Fifty-two percent of caregivers in the present study were unemployed or classified as 'housewives' (See Figure 4.4.2.3). These individuals who did not generate any income comprised the largest group of caregivers who looked after the children during the day. In families with working parents, grandmothers were most often the caregivers during the day. Day care centres and schools were third on the list of caregivers during the day (See Figure 4.4.2.8). Only 45% of the caregivers contributed financially to their households (Refer to Figure 4.4.2.3). Yet, caries prevalence and employment status showed no significant association (Figure 4.4.2.4). In Sri Lanka, employment status of mothers was strongly related to caries experience in their children with higher caries prevalence recorded amongst children of unemployed mothers (Kumarihamy et al, 2011).

The majority of parents in the present study had jobs that required very little skill. Semi-skilled/ manual labourers and unskilled labourers made up 81.2% of the employed workforce. The retail and administrative categories included jobs that required some skill such as clerks, receptionists and sales assistants (Table 4.4.2.3). Only 100 children came from 2-income families.

In the present study, no significant link between caries prevalence and marital status was demonstrated. Only 160 children (43.7%) lived with both their parents (See Table 4.4.2.4). The 3 engaged couples did not live together. One hundred and ninety-nine children did not live with both of their parents. Of these, 47 parents (23.6%) lived on their own without the support of extended family. In 55.2% of cases, children came from homes where extended families lived under one roof. These are families where siblings, parents, grandparents and frequently aunts, uncles and cousins were all living under one roof.

In the present study, the caries prevalence was higher amongst children from larger families where there were 3 or more children in the home (Refer to Figure 4.4.2.6). This association was statistically significant (Figure 4.4.2.7). Livny et al (2007) found that in a Bedouin community, children from families with more than 5 children were '10 times more likely to have caries than children from smaller families' but these differences were not statistically significant (Livny et al, 2007, p.4). This association was also demonstrated by Schroth et al (2010) where a significantly higher caries prevalence was found amongst children who had more siblings.

When it is kept in mind that 40 households had more than 5 adults and 3 households had 10 adults living under one roof, this is a huge financial burden to bear and families in this community have a hard time making ends meet. Sixty-three families relied on some form of formal financial support to survive. This included disability grants (42), pensions (16), child support (5) and other financial aid (4). Twenty-two families were solely dependent on grants and 11 families lived entirely on the grandmother's pension. One of the families had 10 people living under one roof and living off one pension. As a result of these stresses, oral health was usually not high on the list of priorities.

In the literature, different indices have been used to indicate deprivation (also referred to as social exclusion). The definition of 'social deprivation' looks at unemployment as well as the number of single and elderly persons in families (Abu-Kharmeh & Abu-Al Sondos, 2009). Poverty, poor education and low socio-economic status are also included in this definition. 'Material deprivation' refers to unemployment, overcrowding and whether or not individuals own their own homes (Abu-Kharmeh & Abu-Al Sondos, 2009). According to the definition of these indices, many of the households in this study can be regarded as socially and materially deprived.

Psoter et al (2006) demonstrated an association between ECC and ethnicity/ race with poorer individuals being more severely affected. In South Africa, this translates to the so-called black and coloured population groups being more deprived. Postma et al (2008) based their article on the findings of the 1999/ 2002 National Oral Health Survey. In terms of race, they found that 'black' children had the highest caries prevalence followed by 'coloured' children. The Tygerberg Hospital area where the present study was conducted, drains the areas of Bishop Lavis, Ravensmead etc. which is a predominantly a coloured community. The overwhelming majority of patients examined in the present study came from this population group.

Sanders and Spencer (2005) stated that the structure of the family played a role in oral health. The same is true for the level of discipline enforced by the parent and the degree to which the parents were involved in their children's lives. Future caries experience is influenced by 'social and biological factors' that the child is exposed to at a young age (Peres et al, 2005). Low socioeconomic status (Peres et al, 2005; Willems et al, 2005), poor education and malnutrition were identified as some of these factors which predisposed children to caries development (Peres et al, 2005).

4.5.2 Feeding practices

Feeding practices, especially nocturnal feeding, have been implicated in the development of ECC (Bowen & Lawrence, 2005; Prakash et al, 2012). In the present study, children with the more severe form of the disease i.e. those with a combination of s-ECC and ECC, were usually breast and bottle-fed throughout the day and night indicating that frequency of feeds is a significant risk factor in the development of ECC. Mazhari et al (2007) found that the frequency of bottle-feeding was significantly associated with the development of s-ECC in their study population.

4.5.2.1. TYPE OF FEEDING - BOTTLE AND/ OR BREAST

In the present study, children of more educated parents were bottle-fed more often. This could be due to the fact that these parents were more than likely employed and not at home with their children during the day. This association was however not statistically significant (See Figure 4.4.3.2). Parental age did not seem to be associated with bottle feeding practices or the time of day when the bottle was consumed. The time of day that the bottle was consumed also did not have a significant association with caries distribution pattern (See Table 4.4.4.3).

In Prakash et al's Indian study (2012), bottle-feeding at night was associated with a significantly higher caries prevalence. In the present study, the type of feeding practice did not make a difference to the caries experience (See Figures 4.4.3.4 and 4.4.3.5). This finding was supported by other studies as well (Schroth et al, 2010; Mazhari et al, 2007; Livny et al, 2007; Sowole & Sote, 2006).

In a sample of Bedouin children, the method of feeding did not show a statistically significant correlation with caries prevalence (Livny et al, 2007). However, the small sample size should be borne in mind. Amongst rural preschool children of Western Australia, bottle-feeding practices did not differ significantly between children who had tooth decay and those that did

not (Dogar et al, 2011). However, it was reported that the bottles 'mostly contained milk' (Dogar et al, 2011).

Only 65 of the 366 children in the present study were not bottle-fed at all (Table 4.4.3.1). This highlights the fact that most mothers realize the importance of breastfeeding. Parental age and education level (Figure 4.4.3.2) however did not influence whether the child was breastfed as there was no significant association. On the other hand, bottle-feeding showed a significant association with parental education level. As mentioned previously, higher levels of education could be an indicator of better socio-economic status with more educated parents being able to afford the luxury and convenience of bottle-feeding their child. However, the reverse may also be true in that the higher socio-economic status could be due to the mothers also working and earning an income. Thus, they are not able to breastfeed their children. The present study does not allow assumptions to be made as to which is the more likely explanation.

Forty-four of the 65 children (67.7%) who were exclusively breastfed presented with s-ECC. Fifteen of these 44 children presented with s-ECC only and 29 with a combination of s-ECC and ECC. The remaining 2 cases presented with ECC only. This percentage is high but this association was however not significant since the group was small (Figure 4.4.3.1). The time of day that children were breastfed also did not have an effect on the caries distribution pattern (Refer to Table 4.4.4.4).

In a study of randomly selected Indian children, exclusively breastfed children had a 'marginally higher caries prevalence' (Prakash et al, 2012, p.146). Sowole and Sote (2006) found that Nigerian children between the ages of 6 months and 5 years who were predominantly exclusively breastfed presented with a higher caries prevalence. Caries prevalence was not significantly associated with breastfeeding. Interpretation of these results should however be made with caution as discrepancies were noted regarding the definitions used. Definitions used by Sowole and Sote (2006) included 'exclusive breastfeeding', 'predominant breastfeeding' and 'mixed feeding'. The term 'predominant exclusive breastfeeding' was never defined (Sowole & Sote, 2006).

Breastfeeding has been shown to have many benefits and it has been associated with reduced childhood morbidity resulting from gastrointestinal infection (Kramer & Kakuma, 2002). Questions have however been raised regarding the nutritional constituents of breast milk and whether it can provide all the nutrients a growing child needs especially after 4

months (Kramer & Kakuma, 2002; Fewtrell et al, 2007). Cases of iron deficiency have been reported in exclusively breastfed children (Fewtrell et al, 2007). It should also be kept in mind that nutritional imbalances during pregnancy (which may stem from socio-economic status and the cultural environment) may have a negative impact on the composition of breast milk (Kontic-Vucinic et al, 2006).

There are varying opinions and conflicting reports in the literature as to whether breastfeeding can be positively associated with the development of ECC. There is however no recent scientific evidence to suggest a consistent link between breastfeeding and caries (White, 2008; Ribeiro & Ribeiro, 2004; Rosenblatt & Zarzar, 2004; Valaitis et al, 2000; Iida et al, 2007). Yet, in earlier studies, excessive breastfeeding has been associated with decay in some instances (Bowen, 1998; Derksen & Ponti, 1982) albeit to a slightly lesser extent than bottle feeding (Roberts et al, 1994). However, in the latter study (Roberts et al, 1994), this difference was not significant in terms of type and duration of feeding.

The association between breastfeeding and s-ECC was evaluated in a group of 369 children presenting at public health centres in Brazil. In these children aged 36 to 71 months, breastfeeding at night and beyond the age of 12 months was significantly associated with the development of s-ECC (Azevedo et al, 2005). It was however not clear whether this group was exclusively breastfed and if the data on breastfeeding was evaluated separately from children who were bottle-fed (Azevedo et al, 2005).

Amongst low socio-economic areas of Jakarta, Indonesia, breastfeeding was also shown to have no significant correlation with the severity of ECC (Sugito et al, 2008). However, in this particular study, no mention was made of the association between exclusive breastfeeding and caries. Breastfeeding was always supplemented with either formula milk, sweetened tea, sweetened condensed milk or the addition of sweetened foods to the diet (Sugito et al, 2008). Care should therefore be taken when interpreting results and reporting on conclusions drawn from studies.

Comparing data on breastfeeding practices between different studies is complicated by various factors. Some of these factors were brought to light in a study by Iida et al (2007) where data for children between the ages of 2 and 5 years was extracted from the 1999-2002 National Health and Nutrition Examination Survey (NHANES) conducted in the United States. This study concluded that 'breastfeeding and its duration were not associated with the risk of early childhood caries' but the authors conceded that there were 'limitations' which

could have influenced the interpretation of the results (Iida et al, 2007, p.e948). The NHANES data did not include information on supplementary feeding practices, feeding practices at bedtime or frequency of nighttime feeds. Information on duration of breastfeeding practices and introduction of other foods into the child's diet was also dependent on the recall ability of the parents interviewed (Iida et al, 2007). These types of confounding factors make the interpretation of data very difficult and preclude meaningful comparisons between studies. Inconsistencies in study design and methodology also add to the confusion (Valaitis et al, 2000). Studies also do not specify whether breastfeeding practices were exclusive, on demand or at night and this could also hamper the interpretation of results (White, 2008).

4.5.2.2. DURATION OF FEEDING PRACTICES

At present, there is no consensus regarding the ideal time for weaning for both bottle- and breastfeeding. Yet, most sources cite the age of 1 year as a good time to wean. The South African Department of Health, World Health Organization and the American Academy of Pediatrics (2012 and 2005) recommend that children be breastfed for a minimum of 6 months. The American Academy of Pediatric Dentistry (AAPD guidelines, 2012-2013) recommends that children be weaned off the bottle by 12 to 18 months of age. The South African food based dietary guidelines which were formulated by a working group of health professionals focused on paediatrics, put forward a similar recommendation which stated that breastfeeding can continue till 12 months of age (Bourne, 2007). The two latter organizations agree that by this age, children should be weaned and taught to drink from a cup (Bourne, 2007).

The average weaning age in the present study was shown to be much longer than 1 year. All in all, approximately 80% of children (i.e. 131/ 156) in the present study population were still drinking from the bottle after the age of 1 year (Table 4.4.5.1). Close to 50% (145/ 301) of the study population was still on the bottle at the time of examination. Of the 156 children who had stopped drinking bottle by the time of examination, 64 of them stopped bottle-feeding between 2 years and 2 years 11 months of age which is longer than the maximum weaning period cited in the literature (See Table 4.4.5.1). The practice of bottle-feeding did not show a significant association with caries prevalence (Figure 4.4.3.4) but a significant positive association was found between the duration of bottle-feeding and caries prevalence (Figure 4.4.5.1).

Duration of bottle-feeding has been shown to have a statistical correlation with the manifestation of ECC (Begzati et al, 2010). Caries prevalence has also been associated with bedtime feeding practices at 12 months of age (Gao et al, 2011). This time period was clearly exceeded by the group of parents interviewed in the present study.

Where breastfeeding was concerned, a larger percentage (71.2% i.e. 188/ 264) of the study population had stopped breastfeeding by the time of examination (Table 4.4.5.3). Generally, breastfeeding practices were ceased earlier than bottle-feeding which was more convenient, especially in cases where children were looked after by caregivers other than their mothers. Eighty-five of the 188 children (45.2%) who had ceased breastfeeding by the time of examination had stopped breastfeeding by the age of 1 year (Table 4.4.5.3). Breastfeeding practices (Figure 4.4.3.5) as well as duration of breastfeeding was not significantly associated with caries prevalence. The opposite was found in a Nigerian study where a higher caries prevalence was observed with longer durations of breastfeeding (Sowole & Sote, 2006).

a) Demand feeds/ behaviour control

The majority of children in the present study were fed throughout the day and night which indicates a 'behaviour' component to feeding practices. It was clear that in 74.6% of cases, bottle and breastfeeding was used as a means of 'behaviour control' (See figure 4.4.6.1). This was more evident in the children with a combination of s-ECC and ECC.

On demand breastfeeding was shown to be significantly associated with increased caries prevalence. The longer this practice is allowed to continue, the greater the risk for development of ECC (Prakash et al, 2012). Demand feeds should ideally be avoided once the first tooth has erupted (AAPD guidelines, 2012-2013). Children of parents who have difficulty handling stress are also more likely to be at higher risk for developing caries (Menon et al, 2012; Tang et al, 2005). In households where there is a lack of parental support, comforters were cited as a "convenient" and easy way to calm an irritable child (Chan et al, 2002). Parental overindulgence is very common in families where children present with ECC (Johnsen et al, 1984). Some parents use sweets to pacify their children, thereby using it as a method of behaviour control (Mattila et al, 2000). The greater the control of the parent over their child, the lower the caries prevalence (Lenčová et al, 2008).

b) Other feeding methods

Other feeding methods employed i.e. methods used in addition to breastfeeding or use of the traditional bottle included use of a dropper (1 case), feeding cup or cup. Sports drink bottles were also a popular alternative to the traditional bottle. Containers with spouts or bill-shaped mouthpieces were shown to be just as detrimental as ordinary bottles as the sucking action was the same. These vessels have thus also been implicated in the formation of ECC (Behrendt et al, 2001). Bottles with spouts containing juices or sports drinks would probably have a similar effect.

Only 84 children made use of a dummy or pacifier. The dummy was not sweetened in 69 of these cases (82%). Where sweeteners were used, sugar was the preferred choice. Other sweeteners included honey and Scott's emulsion which is a paediatric vitamin supplement. There is no clear evidence in the literature demonstrating a definitive link between ECC and pacifier use. There are also no clear recommendations regarding the use of a dummy or pacifier (Peressini, 2003).

4.5.3 Contents of the bottle

Of the 82.2% (301/ 366) that were bottle-fed, the overwhelming majority (89% i.e. 268/301) received sweetened substances from the bottle (Figure 4.4.7.1). Juice was consumed most often, followed by sweetened tea. The brand of tea was unknown as caregivers could not specify the type of tea that was consumed. Rooibos tea, a traditional South African herbal tea, came third on the list of popular sweetened substances consumed from the bottle (See Table 4.4.7.1). Sweetened beverages, especially at bedtime, have been shown to have a direct correlation with the number of carious teeth (Gao et al, 2011; Kumarihamy et al, 2011). Soft drink consumption was significantly associated with caries experience amongst rural Australian children (Dogar et al, 2011). Soft drinks and fruit juices have also been implicated in dental erosion and should therefore be limited (Steyn et al, 2003). Mineral water and sports drinks which are high in electrolyte content are also not recommended for young children (Bowley et al, 2007).

Only 33 parents claimed that their children only drank unsweetened substances from the bottle. This was clearly the less popular choice of beverage. Only 13 children in this study received pure water from the bottle (Figure 4.4.7.2). Nicklas (2003), as cited by Bourne (2007), recommended that a policy of 'only water after brushing' be adopted. The South African food based dietary guidelines stipulate that from the age of 6 months, children should be offered water at regular intervals and on a daily basis (Bourne, 2007).

Plain cow's milk was the most popular unsweetened substance consumed from the bottle and this showed no significant association with caries distribution pattern (Figure 4.4.7.3). Cow's milk has a lower lactose concentration and is therefore less cariogenic than human milk (Bowen & Lawrence, 2005). However, the American Academy of Pediatrics (2011) recommends that regular cow's milk not be incorporated into the child's diet before the age of 1 year as the digestive system of a baby is not sufficiently developed to be able to digest it effectively. Cow's milk also does not contain the necessary vitamins and minerals which are essential for optimal health. After the age of 1 year, cow's milk can be incorporated into the diet provided it is accompanied with a balanced diet of solid foods. Children should only drink iron-fortified formula milk or breast milk till the age of 1 year (American Academy of Pediatrics, 2011), a fact that parents in the present study were not aware of. Cow's milk is cheaper than formula milk and it is therefore the first choice for parents in this disadvantaged community.

4.5.4 Diet and consumption of sweet foods

In the present study, the majority of children had a cariogenic diet consisting of mostly sweets, juices and potato chips. Only 41 parents in the present study claimed that their children never ate cariogenic foods of any kind yet 15 of these children still presented with caries (Table 4.4.8.1.). Fourteen of these 15 children presented with s-ECC. This caries distribution pattern could therefore possibly be ascribed to the bottle- and breastfeeding practices.

Approximately 30% of parents claimed their children ate cariogenic foods at least once a day with 36.3% reporting that they had it more often i.e. two or more times a day (See Table 4.4.8.1). A significant link between caries and frequency of sweet consumption was demonstrated (Figure 4.4.8.1). Amongst a group of Iranian preschoolers, a significant association was found between snacking frequency and the prevalence of ECC (Mazhari et al, 2007). Restricting sugar intake reduced the chances of caries development.

Sweet treats or drinks should be offered in small amounts at mealtimes and not between meals (Bourne, 2007). Raw vegetables and cheese stimulate saliva production and don't adhere to the tooth surface. Parents should therefore be encouraged to include these types of foods in their children's diets (Bowley et al, 2007).

4.5.5 Oral hygiene practices

Most parents/ caregivers in the present study (94.6%) indicated that they were never taught by a professionally trained person (nursing staff or other) how to care for their own or their children's teeth despite the fact that many of these parents/ caregivers were regular patients at community clinics. Yet, when questionnaires regarding oral health knowledge were completed by the nursing staff, 80.7% of the staff claimed to have been taught to give instructions to parents regarding oral hygiene practices (Refer to Chapter 5).

Most children are taught how to brush their teeth by their parents who themselves might not be well informed. This was illustrated by Sandström et al (2011) who reported that 77% of children in their survey were taught by their parents. Mothers, who are the primary caregivers in most cases, have an important role to play when it comes to introducing their children to good oral hygiene practices as their habits are usually perpetuated in their children (Khadri et al, 2010; Adeniyi et al, 2009).

Very few children in the current study had had their teeth brushed prior to the age of one year (Table 4.4.9.1). The American Academy of Pediatric Dentistry recommends that 'oral hygiene measures be implemented no later than the eruption of the first primary tooth' (AAPD guidelines, 2012-2013, p.51). In the present study, only 21 parents had started cleaning their children's teeth before their first birthday and only 18 parents indicated that they started with oral health measures as soon as the first tooth had erupted. One hundred and twenty-four children had their first exposure to brushing after the age of 2 years with close to 40% of these starting some form of oral hygiene only after 3 years of age (Table 4.4.9.1). If one takes into consideration that teeth are exposed to the acidic oral environment as soon as they erupt at around the age of 6 months, the age at which oral hygiene practices were introduced was too late and the carious process was probably already underway.

In a study conducted in the United Arab Emirates (Khadri et al, 2010), no tooth brushing took place in this age group even though mothers were aware that the teeth had erupted by this time. The most common age for the introduction of oral hygiene practices was between the ages of one and two years but some communities introduced oral hygiene practices much later. In China, close to 27% of migrant preschool children had not even started brushing their teeth by the time they were 5 years old (Gao et al, 2011). A higher prevalence of ECC has been significantly associated with brushing practices initiated at a later age (Mazhari et al, 2007).

It is disturbing to note that in more than 70% of mothers in the present study did not clean the child's teeth after breast- or bottle-feeding and before the child went to sleep, thereby increasing the child's susceptibility to caries development (Figure 4.4.9.1). This acidic oral environment contributed to the high caries prevalence observed in their children. Two hundred-and-seven of the 266 children (77.8%) who did not have their teeth brushed after feeds presented with active caries. This association was found to be statistically significant with those children who had their teeth brushed after feeding displaying a significantly lower caries prevalence (See Figure 4.4.9.2). Of the caregivers who did practise some form of oral hygiene after feeds, the majority did not elaborate as to the method of cleaning used. These parents reported using a damp cloth or rinsing with drinking water or salt water. Eleven parents used glycerine to clean their children's teeth (Table 4.4.9.2). This is an interesting finding as parents who used glycerine claimed that they were told to do so by nursing staff at the clinics.

Forty-four children in this study did not brush their teeth at all (Figure 4.4.9.3) and 18 of them only brushed 'sometimes'. It is interesting to note that 93% of Bedouin children did not have their teeth brushed at all. Yet, the caries prevalence was 17.6% which is very low compared to the prevalence of 71.6% encountered in the present study (Refer to Chapter 3). This low caries prevalence amongst the Bedouin children was speculated to be attributed to their traditional diet (Livny et al, 2007).

Of the caregivers who assisted with oral hygiene of the children in the present study, mothers were the largest group followed by grandmothers. Close to 40% of parents (132/ 366) in the present study felt that their children were old enough to brush their teeth on their own, even as young as 2 years of age (Table 4.4.9.3). One hundred and thirty-two children (36.1%) under the age of 6 years brushed their own teeth without any assistance (Figure 4.4.9.3).

A study amongst children between the ages of 8 months and 4 years in India also found a significant association between caries prevalence and unassisted brushing (Prakash et al, 2012). In an Iranian study, 68.2% of the children were responsible for their own oral hygiene (Mazhari et al, 2007). Another Iranian study (Mohebbi et al, 2008) reported that 35% of 1- to-3-year-old children brushed their own teeth and only 45% of children had their teeth brushed by an adult. Universally, similar reasons are given for allowing children to perform this task on their own. These include that the child is old enough to do so, children did not want to be assisted and that there was no time to supervise this task in large families where there were more pressing issues to deal with (Khadri et al, 2010).

In the present study, unassisted brushing was significantly associated with a higher caries prevalence (Figure 4.4.9.4) and parental age (Figure 4.4.9.5) but not with parental education level (Figure 4.4.9.6). Children do not possess the necessary dexterity to be able to perform the task of tooth brushing adequately until approximately 10 years of age (Sandström et al, 2011). Active parental participation is therefore encouraged, at least until the age of 5 years (Choo et al, 2001). From the age of seven years onwards, children could take more responsibility regarding their brushing practices but this task still needs to be supervised (Sandström et al, 2011). Parental guidance is therefore imperative (Sandström et al, 2011; Khadri et al, 2010).

The overwhelming majority of children in the present study made use of toothbrushes and toothpaste (Table 4.4.9.4). These children had a significantly lower caries prevalence. Eighty-three percent of children had access to fluoridated toothpaste (Figure 4.4.9.7). Yet, the caries prevalence was recorded as 71.6% of all children examined (Refer to Chapter 3). As in other developing countries such as Brazil (Peres et al, 2005), fluoride toothpaste seems to be readily available even in this relatively poor community which was studied. In a cohort of Brazilian children, caries was still evident despite the fact that 95% of them used fluoridated toothpaste regularly and were exposed to fluoridated water since birth (Peres et al, 2005).

Only 21 children in the present study did not use toothpaste, even though they did practise some form of oral hygiene (Table 4.4.9.4). Overall, the method of cleaning did not make a difference to the caries activity.

In an Iranian study, 70% of mothers used toothbrushes to clean their children's teeth. This was followed by use of a washcloth or gauze in 19% of cases (Mohebbi et al, 2008). Exposure to fluoride toothpaste was shown to counteract poor plaque control to some extent (Mohebbi et al, 2008).

In the present study, most popular toothpaste brand was Colgate adult toothpaste followed by Aquafresh kids and Colgate kids (Table 4.4.10.2). Bambino toothpaste was also a favourite. The majority of the children (55%) used kid's toothpaste brands (Table 4.4.10.1). The remaining 45% used adult brands, thereby exposing these children to a higher fluoride concentration and increasing the potential for the development of fluorosis of the permanent dentition.

The caries-preventive effect of fluoride has been shown to be 'almost exclusively post-eruptive', suggesting that the need for systemic fluorides in the form of water fluoridation or fluoride supplements e.g. tablets, is unnecessary (Hellwig & Lennon, 2004, p.258). Pizzo et al (2007) agrees with this sentiment. The need for community water fluoridation as suggested by Van Wyk et al (2004) to reduce the caries prevalence therefore needs to be questioned. As children are already being exposed to a fluoride source, it would seem as though implementing water fluoridation nationwide as an additional source of fluoride is unnecessary. The variations in fluoride content in different water sources also need to be taken into consideration. Fluoride toothpaste provides a means of exercising some control over the total amount of fluoride that is ingested. The use of fluoride dentifrices (preferably referred to as toothpastes in South Africa) is an optimal way of preventing caries on a community and individual level as oral hygiene practices could be combined with fluoride exposure (Hellwig & Lennon, 2004; Pizzo et al, 2007). Parents should however be informed that only a smear of toothpaste should be used for children under 2 years of age and a 'pea-size' amount is recommended for those aged 2 to 5 years (AAPD guidelines, 2012-2013).

In the present study, as brushing frequency increased, caries prevalence significantly decreased (See Figure 4.4.11.2). As was the case in Prakash et al's study (2012), the association between brushing frequency and caries prevalence was statistically significant. The majority of parents in the present study indicated that their children's teeth were brushed more than once a day (Figure 4.4.11.1). This is unlikely when comparing the high caries prevalence of more than 70% observed in this group of children (reported on in Chapter 3) and the age at which oral hygiene was introduced (Table 4.4.9.1).

Policy guidelines formulated by the American Academy of Pediatric Dentistry (AAPD guidelines, 2012-2013) recommend that tooth brushing should be performed twice daily. In contrast to a Swedish study where 91% of participants brushed their teeth two or more times a day (Sandström et al, 2011), only 44.5% of children in the present study fell into this category (Figure 4.4.11.1). A similar trend was noted amongst Arab children where only 36% of them had their teeth brushed a minimum of twice daily (Khadri et al, 2010). In China, only 11.5% of children from migrant families brushed more than once a day (Gao et al, 2011). This attests to the difference in mindset where Swedish parents tend to prioritize oral health more than parents from poorer countries.

4.5.6 Dental history

Dental treatment did not seem to be a priority in the group of patients examined in the current study. Only 17.2% of children had received previous dental treatment (63/ 366). Most parents only went to the dentist when they had a problem and this applied to their children as well. The frequency of dental visits did not show a significant correlation with caries prevalence (Figure 4.4.12.2).

A Swedish study found that dental attendance was poor even when treatment was free and parents were reminded of their appointments (Hallberg et al, 2008). The stresses of daily living (including financial stresses) coupled with the fact that regular dental check-ups was never a priority in their own lives were cited as the reasons why parents did not prioritize their children's dental health. These parents reported only visiting the dentist when they had pain and then also insisted on having their problem teeth extracted. When it came to their children, this mindset was therefore perpetuated (Hallberg et al, 2008).

Negative dental experiences during childhood are carried through to adulthood and influence the type of dental care these parents seek for their children (Smith & Freeman, 2010). Parents want to protect their children from the negative dental experiences that they themselves experienced as children. As a result, dental treatment is often delayed. This means that restorations are uncommon and the child's first dental visit is often associated with pain and more extensive treatment (Plutzer & Spencer, 2008; Peres et al, 2005). Fear of the dentist is therefore perpetuated (Plutzer & Spencer, 2008).

Deeply ingrained parental beliefs also play a role in determining whether or not children receive routine dental care as opposed to purely extractions (Smith & Freeman, 2010). Parents in the present study were generally unaware of the negative impact that extraction of primary teeth could have on the developing dentition. This is highlighted by the fact that 98% of the children who had previous dental treatment received extractions (Figure 4.4.12.3). Restoring or saving teeth did not have a positive connotation amongst the group of parents in this study with many of them citing bad breath and failure of restorations as the main reasons why they would not have their children's teeth restored. They felt that once the tooth was removed, it could no longer be problematic. Only 2 of the 399 children received restorative treatment and only 48% of parents indicated that they would consider restorative treatment.

Treatment usually took place at a very young age with 40 of the children under the age of 4 years (Table 4.4.25.). By the time these children present for treatment, the state of decay is

so advanced that extraction is often the only treatment option. As many of the parents cannot afford the more expensive sedation and general anaesthesia services, these children are therefore traumatized by having their teeth extracted under local anaesthetic. This can result in behaviour management problems if dental treatment is required later which invariably means an increase in the numbers of children requiring sedation and general anaesthesia services. The problem is also exacerbated by the long waiting lists at facilities like the TOHC which services these disadvantaged communities.

A change in mindset is therefore needed to change this perception and encourage parents to choose the conservative treatment option over the more radical approach of extractions.

4.5.7 Additional medical history, premature birth and birth complications

More than 90% of the children were healthy and only 10.9% were born prematurely. Caries distribution pattern showed no significant association with prematurity (See Figure 4.4.13.1). Birth complications (including breech deliveries, forceps deliveries, pre-eclampsia, low birth weight, threatening miscarriages, high risk pregnancies and babies born by caesarian section) were also rare. The high caries prevalence therefore cannot be ascribed to poor general health or perinatal circumstances. Asthma was the most commonly reported medical condition in the group of children surveyed (Table 4.4.13.1). This condition has been associated with increased caries prevalence especially in the preschool age category up to the age of 6 years (Stensson et al, 2010; Stensson et al, 2008).

Only 3 children in this study presented with cellulitis, a severe infection which is potentially life-threatening. The extent of the problem is emphasized by the fact that 2 of these children already presented with cellulitis at the age of 2 years. This condition warrants the prescription of antibiotics and analgesics as well as the need for more complex treatment including emergency extractions, often under general anaesthesia. Early identification of carious lesions that have the potential to flare up could pre-empt this situation.

4.6 Conclusion

It is clear from the results obtained from this study that there is a need to raise awareness about oral health in this community. Caregivers need to be made aware of the infectious nature of caries and the transmission of *Streptococcus mutans*. This includes transmission from sharing utensils or toothbrushes as well as horizontal transmission between children who are in close contact especially at daycare centres and schools. Information on dietary

and feeding practices, the optimal time to stop bottle- and breastfeeding and the benefits of good dental health need to be highlighted. This message also has to be periodically reinforced.

By changing the negative attitude of adult caregivers towards dental care where treatment is sought only in emergencies to one where dental visits are more regular, these positive habits could be passed down to their children. Potential dental problems could then be spotted early and nipped in the bud before more invasive treatment becomes necessary. Focusing on prevention could lead to considerable savings in the future health budget as the need for more expensive treatment options like general anaesthesia and sedation would be reduced.

Support systems should also be put in place so that parents can learn valuable life skills which could provide them with coping mechanisms to help deal with the stresses in their daily lives. By making basic preventive dental care more easily accessible and affordable, parents might be encouraged to take their children to the dentist on a more regular basis thereby taking a step towards reducing the prevalence of this disease. On a larger scale, Willems et al (2005, p.174) suggest that the solution to the high caries prevalence is to focus on reducing socio-economic inequalities by tackling poverty through pursuing 'equity in income, education and social participation'.

4.7 References

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CHAPTER 5

SUB-STUDY ON THE MANAGEMENT OF EARLY CHILDHOOD CARIES IN THE PRIMARY HEALTH CARE SYSTEM

5.1 Introduction

Nursing professionals are involved with primary patient care and are usually the first health care professionals to come into contact with the general public. This is especially true in the poorer, underserved communities. Nursing staff are employed in a variety of health settings which include the private and public sectors and are therefore in a unique position to be able to play an important role in health promotion.

In a study of nurses in the private and public sectors throughout South Africa, it was clear that public sector nurses were generally more dissatisfied. Poor remuneration, huge workload and the lack of resources available to them were the main causes of this dissatisfaction (Pillay, 2009). This was substantiated by Mokoka et al (2011). These factors were identified as the key issues responsible for the decline in the numbers of nursing professionals (Pillay, 2009; Hall, 2004; Van der Colff and Rothmann 2009). Unsatisfactory working conditions, work pressure due to heavy workloads and lack of managerial support, add to the stress that these nurses experience. There are few incentives and opportunities for promotion are scarce (Hall, 2004; Van der Colff & Rothmann, 2009; Mokoka et al, 2011). As a result, there is a serious shortage of nursing health workers in the public sector (Hall, 2004).

In 2004, Hall reported that there were 155 484 nurses practicing in South Africa. This number has dwindled to 118 262 nurses registered with the South African Nursing Council at the end of 2011 (South African Nursing Council website). This is of great concern as nurses play an invaluable role in the delivery of primary health services. In the Western Cape (which has a population of over 5 million people) 14800 nurses were registered with the Nursing Council of South Africa at the end of 2011(South African Nursing Council website). This means that there is only 1 nurse for every 357 people (South African Nursing Council website). A huge

burden is therefore placed on the nursing staff in these communities which are primarily serviced by nurses employed in the public sector (Pillay, 2009). The proposal to extend opening hours in order to improve access to health care and accommodate the public dependent on state services would mean that more staff would be required, thereby exacerbating the staff shortage (Daviaud & Chopra, 2008).

According to Pillay (2009), the public sector sees to the needs of 82% of the population. Yet, it only has access to 40% of the total healthcare budget (Pillay, 2009). As a result, resources are limited (Pillay, 2009; Hall, 2004) and the public sector health care system is often unfairly labeled as 'inefficient and ineffective' (Pillay, 2009, p.2). This in turn can negatively affect the morale of these nurses and may contribute to job dissatisfaction. Ultimately, this can also result in poor service delivery (Pillay, 2009).

Where there is limited access to health care, these health professionals are often the first and only link that poorer communities have to medical care of some sort. This is often also the only port of call for gaining access to information on health matters. The adoption of the 'primary health care approach' means that health professionals have to have an understanding of other disciplines that form part of the health care field (Ogunbodede et al, 1999). Daviaud and Chopra (2008, p.47) also reported a 'drastic shortage of doctors' especially in the rural areas of South Africa with districts having only 7% of the required number of doctors overall. As a result, nurses that are involved in primary health care are understaffed and overworked and are called upon to fill many of the gaps in the existing health care system without necessarily having received the proper training.

Nurses are expected to have knowledge of a wide range of issues and need to be on the forefront of prevention in general. Oral health awareness has however been neglected in the greater scheme of things with infectious diseases such as HIV and TB receiving the most attention. Yet, oral health is an important component of overall health and, if neglected, can ultimately have a negative impact on the rest of the body (Ogunbodede et al, 1999). Training nurses to provide basic oral health care is therefore essential (Walid et al, 2004).

For a country with a population of more than 50 million people (Statistics South Africa 2012), there are not enough dental professionals to address the needs of the public. According to statistics from the Health Professions Council of South Africa's website, at the end of 2010 there were only a total of 6595 oral health personnel registered with the HPCSA. These included dentists, oral hygienists and dental therapists. Only 1282 of these dental staff

practised in the Western Cape. The high caries prevalence amongst children from the lower socio-economic areas surrounding Tygerberg Hospital implies that important information regarding oral health is not filtering through to these communities. The large numbers of young children affected by caries highlights the importance of this topic especially where the education of health care professionals is concerned (Mouradian, 2001).

Children from the lower socio-economic groups tend to only visit a dentist when they have pain (Lewis et al, 2000; Gonsalves et al, 2005). They are more likely to visit a doctor for an overall check-up than they are to pay a visit to the dentist (Pahel et al, 2011; de la Cruz et al, 2004). In the poorer communities, this role is performed by nursing staff. As nurses frequently come into contact with parents and children, they are in a position to impact positively on children's oral health from a young age. They are thus able to play an invaluable role in promoting oral health, especially in communities with limited access to dental care (Walid et al, 2004) and therefore need to be made aware of the risk factors for the development of caries.

By expanding the roles of health care providers in general, the message of prevention can reach the general public (Hallas & Shelley, 2009). This would however add to their already heavy workload and may lead to increased stress levels and frustration if the proper support systems are not put in place. As it is, nurses are barely able to cope with the volume of patients and quality of care is therefore compromised. In addition to this, the administrative aspects of their job are equally demanding (Hall, 2004). Hall (2004) suggests that this workload could be considerably reduced by recruiting volunteers or assistants who are not as skilled and training them to perform routine tasks under supervision, thereby freeing up nurses for the more important tasks. These assistants could also assist with health promotion.

Early identification and intervention for infants and toddlers at high risk of developing dental caries are crucial and guidance from primary health care providers can greatly ameliorate the high prevalence of ECC among young children from the poor socio-economic strata of the population (Kagihara et al, 2009; Tyagi, 2008).

The situation regarding the awareness and knowledge of primary health care workers in the drainage area of the TOHC is unknown. In order to improve their knowledge and utilize their unique opportunities for the early detection of childhood caries, this group of workers needs to be studied in more detail.

5.2 Aims of the sub-study

1. To gain insight into the knowledge of primary health care professionals outside dentistry (delivering care to the children in the study) regarding oral health in children and specifically early childhood caries and its causes.
2. To determine the sources of the knowledge and current practices displayed by non-dental primary health care professionals (nursing staff) regarding oral health.
3. To determine the frequency of routine oral examinations carried out by these professionals and the circumstances under which they are performed.
4. To ascertain whether information regarding oral health is routinely disseminated and the factors which play a role in the type and quality of information being disseminated.

5.3 Methods

A survey was carried out at various community-based clinics, day hospitals, immunization clinics and well-baby clinics in the economically disadvantaged housing areas draining to the TOHC. The available facilities in the drainage area were identified with the aid of the municipal and health officials and health service facilities were selected with their help.

Permission to conduct the survey was obtained from the Acting Deputy-Director General, District Health Services and Programmes, Provincial Administration of the Western Cape as well as the superintendent of each health care facility. Some of the health care facilities approached to participate refused to do so. Thus it was decided that since the number of health care workers obtained in the first round of data gathering was inadequate, the nurses in Tygerberg Hospital who work in the paediatric intake wards and who deliver primary health care services akin to those in the clinics would also be approached. Tygerberg Hospital is officially classified as a tertiary health care centre, but historically the hospital has provided primary health care services to the surrounding community for many years. Before the rural platforms for training of medical students and allied health disciplines were developed, this facility was an important primary health care exposure for students. Permission was therefore also obtained from the administrative office of the Tygerberg Hospital to include nurses who work in the paediatric wards and come into contact with children potentially suffering from early childhood caries.

The following primary care facilities were selected:

1. Adriaanse Clinic
2. Bellville South Community Health Clinic
3. Bishop Lavis Community Health Clinic
4. Elsies River Clinic (second largest clinic with an associated well-baby clinic)
5. Maitland Community Health Clinic
6. Parow Municipal Clinic
7. Ravensmead Community Health Clinic
8. Scottsdene Community Health Clinic (largest clinic also with an associated well-baby clinic)
9. St. Vincent's Community Health Clinic
10. Uitsig Clinic
11. Tygerberg Hospital paediatric intake wards

Only nursing staff who had direct patient contact were included in the study. It was originally envisaged to carry out structured interviews with the nursing staff at the various facilities in order to ascertain their knowledge, attitudes and practices regarding ECC in the daily discharge of their duties. This would help to establish whether the professionals examine the oral status of children that they see, whether they advise the parents/ caregivers on proper prevention of ECC and what advice they give.

Informed consent was obtained from participants (See Addendum E). Due to time constraints and workload, it was not possible to conduct one-on-one interviews with the staff. It was then decided to distribute the questionnaires (See Addendum F) and allow staff to complete them in their own time. Only staff members who agreed to participate were given copies of the questionnaire to complete. The questions included in the questionnaire were based on responses obtained from the parents at the clinics. Basic questions regarding oral health were also included. The completed questionnaires were collected afterwards.

Throughout the questionnaire, the term 'nursing caries' was used in favour of the more recently coined term 'early childhood caries' as it is an older term which more people may have been familiar with. It also implies a specific aetiology (Ripa, 1988). Open and closed-ended questions were included. The completed questionnaires were then collected at a later stage and in so-doing, did not cause disruptions during working hours. Informed consent forms were stapled to the questionnaires and handed to the superintendent of the facility to distribute amongst the health care workers. Once the completed questionnaires were

returned, the superintendent separated the consent forms from the questionnaires and placed them in two separate envelopes before handing the envelopes to the researcher. This way, participant anonymity was preserved. There were an equal number of completed questionnaires and completed informed consent forms, indicating that each participant signed and returned an informed consent form.

Structured telephonic interviews were also conducted by the researcher with the dentists at the dental clinics situated on the same grounds as two of the community clinics. These were the only community public health dentists servicing the entire area. Information was obtained regarding available resources, outreach opportunities and referrals from the clinics. This added a qualitative component to the study which provided better insight into the problems that were encountered.

5.4 Results

A total of 83 nursing staff completed the questionnaires at the various facilities.

5.4.1 General information

Table 5.4.1.1: Distribution of nurses per facility

Site/ facility	Number of nurses (n=83)
1	5
2	4
3	8
4	3
5	4
6	7
7	2
8	9
9	8
10	2
11	31
TOTAL	83

Table 5.4.1.2: Qualifications of nursing staff

Qualification	Number of nurses (n=83)	%
Senior certificate only	5	6.0
Diploma	37	44.6
Degree	11	13.3
More than one qualification	6	7.2
Unspecified	24	28.9
TOTAL	83	100.0

The overwhelming majority of participating nursing staff had diplomas (44.6%). These diplomas encompassed a wide range of descriptions including nursing, nursing management, clinical nursing science, general midwifery and nursing, and community health and management. Only 11 participants (13.3%) had degrees. Thirty-one out of the 83 nurses were “Professional nurses”.

Table 5.4.1.3: Nurses’ perceptions of dental health

Importance of oral health (Scale 1 to 10)	Number of nurses (n=83)	%
1 (Very unimportant)	1	1.2
2	1	1.2
3	0	0.0
4	0	0.0
5	1	1.2
6	1	1.2
7	10	12.0
8	11	13.3
9	9	10.8
10 (Very important)	40	48.2
Did not respond	9	10.8
TOTAL	83	100.0

The overwhelming majority of participating nursing staff themselves only visit the dentist when there is a need.

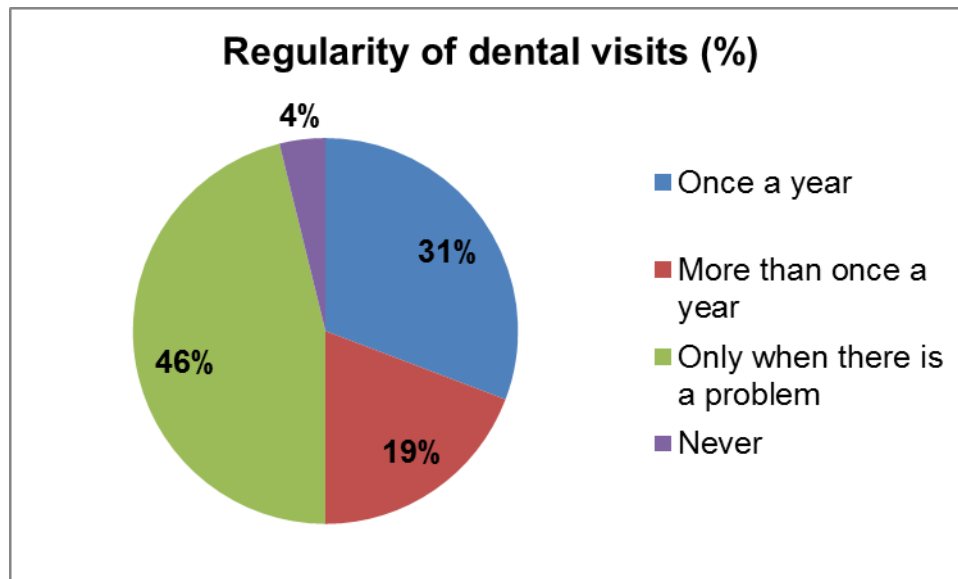


Figure 5.4.1.1: Regularity of dental visits

5.4.2 General oral health knowledge

General knowledge of participating nursing staff regarding oral health is summed up in Table 5.4.2.1

Table 5.4.2.1: General knowledge

Question	Yes % (n= 83)	No % (n= 83)	Blanks (no answer provided) % (n= 83)	Limited knowledge % (n= 83)	Don't know % (n= 83)
Do you know what causes cavities?	91.6	4.8	3.6	0	0
Do you know how cavities can be prevented?	88.0	4.8	6	1.2	0
Do you know what causes nursing caries and how to prevent it?	42.2	47.0	10.8	0	0
Do you know how to prevent nursing caries?	41.0	48.2	10.8	0	0
Do you think milk teeth are important?	92.8	4.8	2.4	0	0
Should milk teeth be restored?	43.4	41.0	6	0	9.6

Forty-seven percent of nurses had no idea what caused “nursing” caries. Of those who had heard of “nursing” caries, the majority obtained this knowledge through reading.

Even though 92.8% (77/ 83) of respondents felt that milk teeth were important, nearly half of them were not sure about the value of restoring these teeth.

Approximately 52% of the nurses suggested that children visit the dentist for the first time at 2 years of age or older. The full responses are represented in Table 5.4.2.2.

Table 5.4.2.2: Nurses' suggested age for child's first dental visit

Age		No of responses (n=83)	%
Specified age (72)	6 months	1	1.2
	8 months	1	1.2
	9 months	2	2.4
	1 year	19	23.0
	1 yr 6 months	5	6.0
	2 years	28	33.7
	3 years	5	6.0
	4 years	1	1.2
	5 years	4	4.8
	6 years	6	7.2
Don't know		4	4.8
As soon as teeth erupt		5	6.0
Blank/ no answer provided		2	2.4

Table 5.4.2.3: Nurses' knowledge of fluoride (n=83)

Question	Yes % (n)	No % (n)	Blank (no answer provided) % (n)
Do you know what fluoride is and what it does?	85.5% (71)	12.1% (10)	2.4% (2)
Have you heard of fluoride varnish?	50.6% (42)	45.8% (38)	3.6% (3)

Even though 85.5% of nurses had heard of fluoride and claimed to know what it does, nearly half had no idea what fluoride varnish is.

Sixty-six out of 83 health care workers who responded did not prescribe fluoride supplements. Thirteen of them did prescribe supplements, but only 2 prescribed the correct

dosage. More than 60% of the participants did not know how much fluoride would be acceptable for a child between the ages of 6 months to 1 year living in Cape Town.

Close to 70% of nurses had never heard of fissure sealants. The numbers of nurses who claim to have informed parents that sugar-free medications were available is reflected in Figure 5.4.2.1.

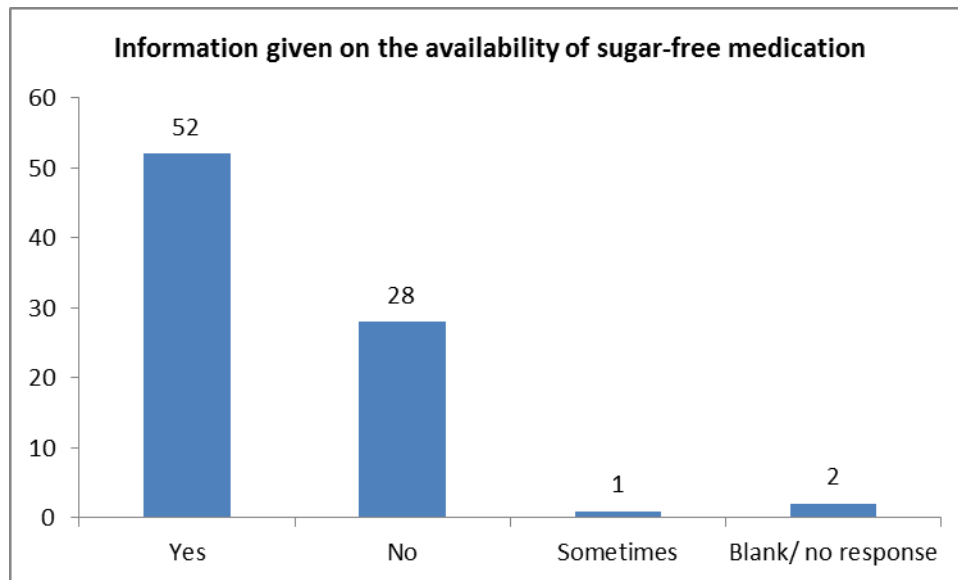


Figure 5.4.2.1: Number of nurses who informed parents of the availability of sugar-free medication

5.4.3 Nurses' knowledge of feeding practices

When asked about the most appropriate time to wean a child off the bottle, only 26.9% of respondents answered correctly.

Table 5.4.3.1.: Nurses' suggested age for cessation of bottle-feeding

Age		No of responses (n=83)	%
Specified age (70)	6months	3	3.6
	9 months	1	1.2
	1 year	17	20.5
	1 yr 6 months	10	12.1
	1yr 7 months	1	1.2
	2 years	31	37.3
	2 yrs 6 months	1	1.2
	3 years	6	7.2
Don't know		5	6.0
Should not drink bottle		3	3.6
As soon as the child can drink from a cup		2	2.4
Blanks/ no answer provided		3	3.6

Table 5.4.3.2: Nurses' suggested age for cessation of breastfeeding

Age		No of responses (n=83)	%
Specified age (72)	6months	5	6.0
	1 year	12	14.5
	1 yr 6 months	2	2.4
	2 years	32	38.6
	3 years	11	13.3
	4 years	8	9.6
	5 years	2	2.4
Don't know		7	8.4
As long as he/ she demands it		2	2.4
Blanks/ no answer provided		2	2.4

The majority of respondents suggested cessation of breastfeeding should take place at around 2 years of age.

A combined 30.1% (25) attributed their knowledge of feeding practices to 'own experience' and 'personal opinion'. Only 11 claimed to have gained this knowledge during their training and 4 attended breastfeeding courses. Magazines and pamphlets also featured high on the list of sources for obtaining knowledge regarding feeding practices.

All participants agreed that diet plays a role in dental health and that parents should be counseled about their child's diet. None of them felt that parents/ siblings sharing utensils and toothbrushes were acceptable practices and in excess of 90% of respondents recognized that putting a child to bed with a bottle was not an appropriate practice.

5.4.4 Nurses' knowledge of oral hygiene practices

Most participants indicated that their knowledge regarding oral health practices was largely acquired from their parents and from school. Ten of them claimed to be "self-taught". Approximately 90% (74) of the health care professionals knew what dental floss was and thought that it was necessary to floss one's teeth. However, when asked whether it was necessary to floss a child's teeth, the number of positive responses dropped by 21.7% (See Table 5.4.4.1).

Table 5.4.4.1.: Question-- Do you think it's necessary to floss a child's teeth?

	Number of responses (n=83)	%
Yes	56	67.5
No	22	26.5
Don't know	2	2.4
Sometimes	1	1.2
Blank/ no answers provided	2	2.4

In general, nurses claimed that their parents were the main source of knowledge where oral health practices were concerned.

Responses regarding when a child would be able to brush their teeth on their own yielded some interesting and disturbing responses. These are reflected in Table 5.4.4.2. Not a single response was correct.

Table 5.4.4.2: Nurses' suggested age when a child can start brushing his/ her own teeth

Age		Number of responses (n=83)	%
Specified age (68)	2 months	1	1.2
	8 months	3	3.6
	9 months	2	2.4
	10 months	1	1.2
	1 year	19	22.9
	1 yr 6 months	3	3.6
	2 years	19	22.9
	2yrs 6 months	1	1.2
	3 years	11	13.3
	4 years	2	2.4
	5 years	5	6.0
	6 years	1	1.2
Don't know		3	3.6
As soon as the teeth have appeared		6	7.2
Once child starts going to crèche		1	1.2
As soon as the child is able to do it		2	2.4
Blanks/ no answers provided		3	3.6

Table 5.4.4.3: Nurses' overall knowledge of oral health

	Number of responses (n=83)	%
Adequate	50	60.3
Lacking	26	31.3
Blank/ no answers provided	7	8.4

5.4.5 Scope of duties**Table 5.4.5.1: Question-- Do you routinely perform oral examinations on children?**

Oral examinations performed	Number of responses (n=83)	%
Yes	39	47.0
No	42	50.6
Sometimes	1	1.2
Blank/ no answers provided	1	1.2

The following benefits of performing an oral examination are listed in Table 5.4.5.2. More than one reason was often chosen.

Table 5.4.5.2: Positive aspects of the oral examination

Responses recorded	Total number of responses	%
To assess for ENT problems	7	8.4
Look for thrush	4	4.8
Look for dental abscesses/ caries	16	19.3
To know when to refer patient to the dentist	4	4.8
To spot problems early	15	18.1
Important for general health	4	4.8
Don't know	1	1.2
Blank/ no answers provided	42	50.6

*Some participants provided more than one answer regarding the positive aspects of performing an oral examination

Reasons why oral examinations were not performed routinely included the following:

- It falls outside the scope of the job
- Nursing staff are not equipped with the skills to perform such a task
- It is a totally different service

5.4.6 Content of the undergraduate curriculum

When asked about whether the undergraduate curriculum contained information on giving advice to patients/ parents regarding oral hygiene and feeding practices, more than 80% of respondents indicated “yes” on both counts. However, only 5.4% of parents interviewed in the parallel study (Refer to Chapter 4) stated that they were taught this by nursing staff. Approximately 65% of nurses claimed to have been taught about the cessation of bottle feeding, yet only 20.5% of them got the answer right.

The overwhelming majority felt that a dental examination should be included in the routine exam. Reasons provided for this included that it would help with the diagnosis of ear, nose and throat (ENT) problems and thrush as well as help with the early identification of abscesses, caries and other potential problems.

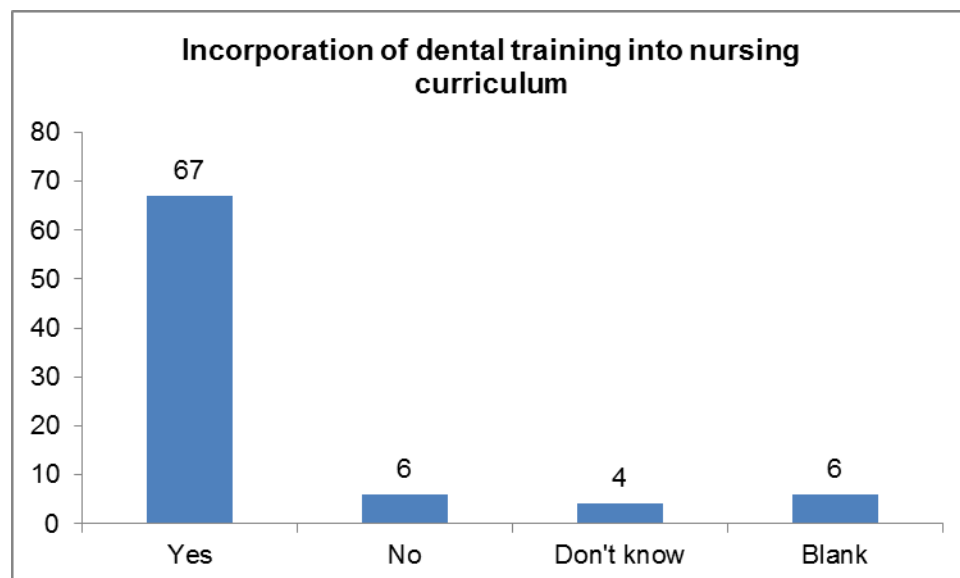


Figure 5.4.6.1: Number of nurses who felt that it was a good idea to incorporate training on dental matters into the nursing curriculum

5.5 Results (Qualitative)

Telephonic interviews conducted with the two dentists at the two dental clinics situated on the same premises as two of the community clinics revealed the following:

- The community clinics do not routinely send patients to the dental clinic for treatment—patients are usually only referred when they complain of pain.
- Patients generally attend the dental clinic voluntarily when needed.
- Outreach to clinic next door is more often for TB than dental caries.

- The dental clinic has, on occasion, arranged a programme for staff at the community clinic but this does not happen often.
- At one of the clinics, the oral hygienist apparently presents talks at the clinic every now and then.
- The dentists who were interviewed indicated that they would like to have more time for education and prevention and get more involved with raising awareness of oral health at the community clinics, but the lack of resources means that there is no time to do so even if they wanted to.
- Parental attitude influences the type of dental treatment provided at these clinics.
- Other parental factors such as not being able to get off from work in order to take the child for multiple visits also played a role in the choice of treatment. In these cases, extractions were usually favoured.

5.6 Discussion

According to Daviaud and Chopra (2008), in South Africa, nurses fall into 3 categories depending on the duration of their training. Only 31 nurses listed their title as 'Professional nurse' which is the category with the longest duration of training i.e. 4 years. There were 8 'nursing assistants' who had 1 year of training. The rest of the nurses listed a range of descriptions for their job titles which cannot be assigned to any of the 3 categories listed by Daviaud and Chopra (2008). None of the nurses described their title as "enrolled nurses" who have 2 years of training (Daviaud & Chopra, 2008).

5.6.1 Nurses' attitude to dental care

Despite the fact that the overwhelming majority (84%) of the participants in this study rated the importance of oral health as 7 out of 10 or above, only 22% of them visited the dentist twice yearly as recommended. Similarly, only 20% of nurses in Lesotho visited the dentist every 6 months (Walid et al, 2004).

Forty-six percent of nurses in the present study stated that they only visited the dentist when they required dental treatment (Refer to Figure 5.4.1.1). This was usually only when they had toothache. A similar trend was noted in a study by Walid et al (2004) where 60% of nurses only made use of dental services when they needed to. Lack of accessibility to dental clinics was also cited as a reason for irregular dental visits (Walid et al 2004).

There is a clear gap in the knowledge as to the value of preserving the primary dentition. Even though 92.8% of the participants in the present study felt that 'milk teeth are important', only 43% of them indicated that milk teeth should definitely be restored (Figure 5.4.2.1). This mindset was perpetuated in the parents seeking dental treatment for their children at the adjacent dental clinics. Dentists at these clinics reported that the attitude of the parent determined the type of treatment they provided. Extractions were the treatment of choice amongst parents of children who presented at the dental clinics. Parents felt that 'milk teeth' would fall out anyway and therefore did not need to be restored.

In addition to improving accessibility to dental services, a change in mindset first needs to occur among these nursing professionals if they are to effect a change in the mindset of their patients. By improving their own oral health and developing a more positive attitude towards dental care, they are more likely to encourage their patients to do the same.

5.6.2 General knowledge of oral health

Questions regarding general oral health included in the questionnaire aimed to assess knowledge on the causes of cavities and how they could be prevented. Answers provided by the nurses revealed that more than 88% of them knew what causes cavities and how to prevent them (Table 5.4.2.1). Yet, just over 40% of them had heard of "nursing" caries and how it could be prevented. If one takes into consideration that 10.8% left the question blank, the percentage who did not know what nursing caries was could be closer to 60%. In general, approximately 60% of the nurses themselves felt that their knowledge regarding oral health matters was lacking (See Table 5.4.4.3). Ogunbodede et al (1999) and Walid et al (2004) found that participants in their studies possessed only very basic knowledge of oral health and prevention.

In the group of children visiting these health care facilities, the highest caries prevalence was found to be in the 3 year to 3 years and 11 months age group (See Chapter 3). The first dental visit should therefore ideally take place before this time so that preventive measures can be instituted, thereby preventing caries progression in this vulnerable group of patients. Interestingly, 33.7% of health care workers in the present survey suggested that children should only visit the dentist for the first time after the age of 2 years (Refer to Table 5.4.2.2). By that time a large number of children would already be affected by the carious process and curative measures rather than preventive measures might be needed. According to the American Academy of Pediatric Dentistry guidelines (AAPD guidelines, 2012-2013a & b), dental counseling and examinations should take place within 6 months of eruption of the first

primary tooth and no later than one year of age. Most children have had some contact with primary health care workers by the age of 1 year.

Parents need to be made aware that caries is infectious in nature and should be briefed on the causes and prevention of dental caries (Marrs et al, 2011). Even paediatricians in the United States were unaware that caries is an infectious process or that it can be transmitted to the infant from the mother (Lewis et al, 2000; Gonsalves et al, 2005). This low level of familiarity with the clinical manifestations of ECC significantly hampers the utilization of health care workers (other than dentists) in the prevention of serious oral health problems in young children. Educating these professionals regarding oral health would therefore empower them and enable the early identification of potential problems.

5.6.3 Knowledge of preventive measures

Implementation of simple preventive measures such as fluoride application by primary health care workers could be a valuable tool for preventing caries, especially in high risk patients (Mouradian et al, 2003b; Graham et al, 2003). As was the case in Lewis et al's study (2000), it is clear that the participants in the present study had very limited knowledge about preventive measures like fluoride varnish and fissure sealants.

In the present study, only about 50% of nurses knew that the child's overall fluoride intake needs to be assessed before prescribing supplements. However, the majority (55.4% i.e. 46/ 83) correctly stated that fluoride supplements are not necessary if the water is fluoridated optimally.

According to the responses received, the availability of sugar-free medications was discussed with parents in 62.6% (52/ 83) of cases (Figure 5.4.2.1). However, when compared with responses obtained from parental interviews in a parallel study (See Chapter 4), the accuracy of this figure needs to be questioned. Sugar-free medications are not available at Tygerberg Hospital, yet 20 of the 31 nurses (64.5%) there claimed to inform parents that these medications are available.

5.6.4 Knowledge of feeding practices

The majority of responses obtained regarding the cessation of breastfeeding (Table 5.4.3.2) are in accordance with the guidelines provided by the South African Department of Health (2007). The guideline recommends 'exclusive breastfeeding for the first 6 months and continued breastfeeding up to two years of age or beyond' (p.3). This is similar to the World

Health Organization (WHO) guidelines which recommend breastfeeding up until the age of 6 months. However, no real consensus has been reached in the literature regarding the duration of breastfeeding. According to the American Academy of Pediatric Dentistry guidelines (AAPD guidelines, 2012-2013a), on demand breastfeeding should be discouraged once the first tooth has erupted. The American Academy of Pediatrics (2005) suggests breastfeeding duration for 6 months to 'at least the 1st year of life' (p.499). After 7 years, the recommendation remains unchanged in a follow-up policy document (American Academy of Pediatrics, 2012). In general, most sources agree that the duration of breastfeeding should be at least six months.

From around the age of 1 year, children should also start drinking from a cup and should be weaned off the bottle by the age of 14 months (AAPD guidelines, 2012-2013a). Only 21 respondents stated that children should be weaned off the bottle by their first birthday (Table 5.4.3.1). When it comes to general dietary advice, health care workers can also provide parents with information regarding healthy eating patterns and food choices (Mobley et al, 2009).

5.6.5 Knowledge of oral hygiene practices

It is disquieting to note that 57.8% of all respondents (i.e. 48/ 83) felt that children 2 years of age and below were able to brush their teeth on their own (Table 5.4.4.2). They were unaware that children need to be actively assisted with tooth brushing, sometimes up to the age of 10 years, as they do not have the necessary dexterity to perform the task adequately (AAPD guidelines, 2012-2013a; Sandström et al, 2011). Only 6 participants knew that a child's teeth should be cleaned as soon as they erupt in the mouth (Table 5.4.4.2) and many nurses were not convinced about the benefits of flossing a child's teeth (Table 5.4.4.1).

5.6.6 Scope of duties and attitude towards the provision of oral health knowledge

Even though the attitude of the health care workers in the present study towards providing an oral screening service was mostly positive, nearly 10 percent of respondents felt that performing oral examinations fell outside the scope of their jobs and that they were not trained to do so. Staff shortages and time constraints were two of the reasons provided why oral examinations are not performed routinely.

Despite the fact that nearly half of the health care workers (40/ 83) did not perform oral examinations routinely, 69.8% of all respondents felt that incorporation of a dental

examination into the routine examination was a good idea. More often than not, in cases where oral examinations are performed, the teeth are most probably overlooked.

Feedback from dentists at clinics situated on the same premises as the community clinics revealed that patients usually attend the dental clinic voluntarily and are only referred from the clinic next door if the child has pain. Routine referral of patients from the community clinics for dental treatment does not happen often. These health facilities included in the present study were also not exposed to training sessions in oral health promotion. One of the clinics did however report that an oral hygienist does occasionally present talks there. Excellent opportunities for collaboration exist at these sites, yet they are not being used.

Raising awareness of oral health amongst nursing staff is imperative. Even training sessions of short duration can enable non-dental personnel to identify cases in need of referral (Pierce et al, 2002). Pierce et al (2002, p.2) showed that, even though paediatric primary care providers tended to 'under-count the number of teeth with carious lesions', they achieved an acceptable level of proficiency at identifying cavitated lesions after only 2 hours of training in infant oral health. The purpose of the information session was not to be able to accurately identify cavities on each and every tooth but rather to familiarize them with various oral health conditions (Pierce et al, 2002). It is important that primary health care workers understand the dental caries process and gain competency in identifying basic oral health problems so that cases that need to be referred can be identified.

Dental screenings can easily be incorporated into the normal routine of every health care worker (Pierce et al, 2002). Newborn nurseries and well-baby appointments have been suggested as the ideal non-threatening environment to introduce prevention for children and educate their parents about oral health care (Hallas et al, 2011; Drummond et al, 2002). In programmes where the application of fluoride varnish was introduced at well-baby visits, fluoride was sometimes not applied due to time constraints but in general, participants agreed that it was important to include an oral health component in well-baby visits (Graham et al, 2003). By utilizing these visits, opportunities for oral screenings before the age of two years are increased seven-fold when compared with dental visits (Gonsalves et al, 2005). When parents start noticing their child drooling, they often enquire about the teething process. This has been suggested as the ideal time to address the transmission of *Streptococcus mutans*, the causes of caries and give advice on oral hygiene and feeding practices (Wagner, 2006). This sharing of information can happen from as early as the prenatal period and can then be reinforced at each well-baby visit (Hallas et al, 2011). Early

identification of potential problems would prevent the need for more complex treatment further down the line.

In order to target children who are at risk of tooth decay at an early age, collaboration between various professionals in the health sciences professions is required (Mouradian, 2001; Hallas et al, 2011). Hallas et al (2011) suggested that children be assessed dentally for the first time at around 9 months of age, soon after a few teeth have erupted and agree with the American Academy of Pediatric Dentistry (AAPD guidelines, 2012-2013a) that this examination should not be delayed beyond 1 year of age.

Providing nurses with the necessary skills will enable them to perform these tasks with confidence and they would thus be more likely to put into practice what they have learnt.

5.6.7 Drawbacks of the promotion of oral health by health care workers

Some drawbacks to the promotion of oral health by health care workers in several settings were identified in various studies.

5.6.7.1. LACK OF UP-TO-DATE INFORMATION AND KNOWLEDGE ON ORAL HEALTH PREVENTION

Health care workers are generally not keen to give advice on topics with which they were unfamiliar (Mouradian et al, 2003b; Lewis et al, 2000; Gonsalves et al, 2005; de la Cruz et al, 2004; Pierce et al, 2002). Lack of confidence especially regarding performing a dental examination, identification of dental caries, providing parents with instructions on tooth brushing and uncertainty in the application of fluoride, were cited as possible barriers to implementing oral health activities and prevention (Lewis et al, 2009). These health care providers therefore need to be educated regarding the prevention of this disease process (Walid et al, 2004). By improving their confidence, they will be more likely to perform this task and provide their patients with oral health care advice.

5.6.7.2. LACK OF TIME

A single well-baby visit can often be very demanding as many tasks have to be completed during this visit. In such cases, more important issues would take precedence over oral health (Mouradian et al, 2003b; Lewis et al, 2009; Lewis et al, 2000; Gonsalves et al, 2005). Pierce et al (2002, p.3) suggested that 'dental screening could easily be incorporated into a busy pediatrics practice'. Wagner (2006), a paediatrician by profession, found that it takes less than 30 seconds to inspect the teeth and the perceived 'lack of time' should not be a

deterrent to performing this task. He claimed that time could be maximized by talking about nutrition, feeding habits and oral hygiene while performing the examination.

5.6.7.3. PROBLEMS WITH REFERRALS

Increased awareness amongst health care professionals regarding oral health matters would result in a greater number of these children being referred for dental treatment. More dental professionals would therefore be required to address these referrals (Mouradian et al, 2003a). Some health professionals found that dentists were not willing to accept referrals, especially for very small children (Mouradian et al, 2003b; Lewis et al, 2009; Lewis et al, 2000). These children often require extensive work and as general dentists might not have received adequate training regarding the various psychological and behavioural aspects of dealing with children, this could be another reason why they turn down these patients (Mouradian et al, 2003a).

From interviews with the dentists stationed on the same grounds as the health care facilities included in this survey, it was clear that they are also understaffed, overworked and are only able to provide a limited service. They conceded that the shortage of dental staff meant that they could not emphasize prevention as often as they would have liked and that the service they provide includes mostly extractions of problematic teeth and limited restorative treatment in children under the age of 6 years. Up to 100 extractions a week can be performed at these clinics in children under the age of 6 years. By the time the children present for treatment, teeth are often too far gone to save and in younger children where behaviour management is problematic, these clinics often have no choice but to refer patients to the nearby TOHC for comprehensive treatment where the waiting lists, especially for general anaesthesia and sedation services, are already extensive. The dentists also reported that the lack of resources such as the problems experienced with the ordering of materials and equipment, compromises the quality of comprehensive care that they are able to provide.

Nurses are the backbone of the South African health care system. By addressing the concerns of remuneration, workload and by making more resources available to enable nurses to perform their duties more effectively, more individuals may be encouraged to take up the profession of nursing which is essential to the effective delivery of health care in South Africa. The necessary support systems are imperative if nursing staff are to play a meaningful role in oral health promotion and caries prevention.

5.6.8 Curriculum content

In the present study, approximately 80% of respondents (67/ 83) felt it was necessary to include information on prevention and oral health in the undergraduate curriculum (Figure 5.4.6.1). They also felt it necessary to be taught how to perform an oral examination. This sentiment was already echoed in Rudolph and Ogunbodede's study in 1999 where a questionnaire circulated to nurses attending an international health care conference in Pretoria revealed that 96.7% of nurses felt that aspects of oral health should be incorporated into the nursing curriculum. More than 50% of them felt that their exposure to oral health during their nursing training was 'inadequate'.

Nurses' lack of knowledge on oral health matters demonstrated in the present study raises questions as to the adequacy of the content being offered on this subject in the nursing curriculum. An oral health promotion initiative provided to nurses in Acornhoek, South Africa, showed that even over a period of as little as 4 days, a significant improvement in oral health knowledge and skills was noted (Ogunbodede et al, 1999). Yet, to date, not much has been done to incorporate aspects of oral health into the nursing curriculum. Several attempts to contact the South African Nursing Council to obtain official information regarding the content of the present nursing diploma curriculum proved to be fruitless. From informal conversations with nurses involved with the training of nursing students, it seems as though the current curriculum being offered at nursing schools in the Western Cape does not include adequate information regarding oral health prevention and feeding practices. The knowledge of nurses regarding various aspects of oral health is seriously lacking.

In a study by Gonsalves et al (2005, p.7) participants stated that 'routine assessment for early signs of dental problems' and 'counseling on the prevention of dental problems' should be incorporated into the medicine residency training. Likewise, these issues should be covered in the nursing curriculum as well.

5.6.9 The way forward

Primary health care workers have an invaluable contribution to make in terms of improving the oral health of these underserved communities especially where there is a shortage of oral health professionals (Plutzer & Spencer, 2008; Walid et al, 2004). However, shortages of nursing staff could lead to added pressure and cause them to neglect the oral health aspect in favour of more important health issues.

Health care workers who are knowledgeable about preventive oral health and are able to recognize oral disease and other potential problems early can refer these patients for dental care before major problems start developing (Mouradian et al, 2003a; AAPD guidelines, 2012-2013b). This would help alleviate the stresses on comprehensive dental services as well as general anaesthesia. However, in order to be able to provide this service, nurses need to be trained. It should be borne in mind that conferences and opportunities to improve their knowledge are often outside the reach of nurses in the public sector (Rudolph & Ogunbodede, 1999).

It is important that systems are put in place to be able to deal with the expected increase in the number of referrals for invasive dental treatment. More treatment facilities need to be made available for the comprehensive dental treatment of these referred patients. This is especially problematic in rural areas where there are limited numbers of dental practitioners (Lewis et al, 2000). This also presents a case for increasing the numbers of paediatric dentists who are trained in dealing with the psychological aspects of behaviour management and who can provide a comprehensive dental service to their patients. This discipline however, first needs to be a recognized specialty in South Africa.

Another alternative which would help alleviate the burden placed on the limited existing oral health services is to invest in the training of dental therapists. Internationally, dental therapists provide basic preventive and restorative care for children at a fraction of the cost (Nash, 2009). With slight amendments to the undergraduate programme, oral hygienists could also provide a similar service (Nash, 2009). Monajem (2006) felt that oral hygienists are better suited to promote oral health on a community level as their job focuses on preventive oral care. Conversely, the dental profession is more 'technically-driven' and more 'curative' in nature (Monajem, 2006). Oral hygienists are however restricted to practise under supervision and this restriction could hamper their ability to provide primary health care on a more widespread basis (Monajem, 2006). This restriction should perhaps be revisited in order to improve access to preventive dental care.

Dentists should also play a more active role in disseminating information to health care providers. Wagner (2006) suggested that dentists initiate contact with paediatricians and provide them with the latest information regarding the prevention of oral disease. They could even offer to do presentations and teach health care workers how to conduct oral examinations (Wagner, 2006). Information on oral health care should be made more accessible to health care providers (Douglass et al, 2009). This type of collaboration would

serve to improve working relationships, open the way to better communication and improve service delivery to the masses.

5.7 Conclusion

It is clear from the results of this study that knowledge of oral health related matters is lacking in the group of health care workers surveyed. The knowledge that they do have has been attributed to various sources which in part included their training institutions. However, in general, 'own experience' was the most common source of knowledge listed. This suggests that the oral health knowledge received during training is inadequate. Health care workers need to take responsibility for reducing the prevalence of ECC (Wagner, 2006).

It is therefore important that information on oral health prevention be incorporated into the undergraduate curricula before these professionals are expected to provide this service to their patients (Graham et al, 2003). In addition to improved access to health care, a 'greater integration of dentistry with medicine and other health and social systems serving children and families, is needed (Mouradian, 2001; Mouradian et al, 2003a). Gaps in the primary health care settings can be filled by overlapping the roles of health care providers and providing 'cross-disciplinary education' (Wessel, 2005; Hallas & Shelley, 2009). In so doing, the message of prevention can reach more patients and they can be treated more efficiently. This type of interdisciplinary care or team approach to oral health promotion will ensure that patients are able to receive the best possible holistic care, especially in the rural communities where access to dental care is currently limited.

Health professionals should be educated on what is normal so that they are able to spot pathology that would warrant immediate referral (Hallas et al, 2011). Current undergraduate curricula should also be adapted to include the latest preventive practices in dentistry. Strategies can then be developed to improve the quality of information being disseminated to the broader community.

Clinical training which includes hands-on training on how to do oral examinations and apply fluoride varnish needs to be incorporated into undergraduate curricula of all health professions (Lewis et al, 2000; Walid et al, 2004; AAPD guidelines, 2012-2013c). Collaborative efforts between nursing and medical institutions with the dental profession and affiliation with dental schools/ faculties at universities would help to improve the quality of preventive care that can be provided to the broader public. It is also important to reach

practitioners who have already graduated and might not have had exposure to recent oral health initiatives by providing them with opportunities to update their knowledge.

In order to raise awareness and remind health professionals to look at patients more holistically, a checklist highlighting certain dental aspects could be incorporated into the paperwork that is currently being used during well-baby visits and all general medical examinations pertaining to children.

As nurses are on the frontline when it comes to the provision of health care, investing in training and education should be a priority. The training of public health nurses who come into contact with the public at community level and deal with mothers and children on a daily basis should receive particular attention, especially in areas where there is a shortage of dental personnel. They should be empowered to advise parents on proper oral hygiene, diet and the prevention of tooth decay. By expanding the curriculum to include training in oral health matters and by raising awareness as to the importance of oral health, inroads can be made into tackling the huge problem of early childhood caries.

5.8 References

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CHAPTER 6

MULTIVARIATE ANALYSIS OF DATA POOLED FROM ALL THREE SUB-STUDIES

6.1 Introduction

The previous three chapters were analysed separately. However, when data of all three chapters are compared, multivariate analysis is necessary to ensure that when all the data sets are looked at together, no major discrepancies in the results are noted.

Logistic regression has been used to predict whether a child has ECC, based on the observed characteristics of the child (age, gender, etc.). Logistic regression predicts the odds of having ECC based on the values of the independent predictor variables in the study. The odds in the present study are defined as the probability that a particular outcome is a case of ECC divided by the probability that it is a non-case (i.e. healthy dental condition). Since this is an analysis incorporating all three major sub-themes (child ECC and demographics, parental aspects and aspects of health care workers) simultaneously, the results of this analysis are represented separately in this short chapter. The details of the sampling strategy, sampling sites, methods etc. are already described in the individual chapters on the three sub-studies.

6.2 Results of multivariate analysis

The first analysis was to determine whether the data from the three sub-study data sets could be pooled. Levene's test is used to assess the equality of variances for a variable determined for two or more groups. It tests the null hypothesis that the population variances are equal. If the null hypothesis of equal variances is rejected it is concluded that there is a difference between the variances in the population (Levene, 1960). Levene's test for homogeneity of variances was non-significant ($p=0.66$). It was thus concluded that the three data sets could be pooled.

The data set representing the information obtained from the caregivers only contained 366 caregivers of 465 children, since the children surveyed at the crèches did not have an accompanying caregiver to interview. This meant that an accurate representation of the full sample of caregivers (as represented in Chapter 4) could not be used in the multivariate analysis. Before subjecting the data to logistic regression analysis, it was first investigated whether the removal of the data for the children for whom no caregiver information was available resulted in skewing the remaining portion of the data set. It was found that the remaining data set was representative of the entire sample (difference non-significant, $p=0.34$).

The results of the logistic regression for the pooled data set can be found in Table 6.2.1.

Table 6.2.1: Logistic regression

any ECC - Parameter estimates (children logistic regression in results.stw)								
Distribution : BINOMIAL, Link function: LOGIT								
Modeled probability that any ECC = yes								
Include condition: "valid1"="yes"								
Effect	Level of Effect	Column	Estimate	Standard Error	Wald Stat.	Lower CL 95.0%	Upper CL 95.0%	p
Intercept		1	-0.497048	1.253260	0.157295	-2.95339	1.959297	0.691660
Question 20		2	1.150264	0.418117	7.568312	0.33077	1.969759	0.005940
Question 48		3	-0.225541	0.205096	1.209306	-0.62752	0.176440	0.271470
Question 38(Child)		4	0.787799	0.356204	4.891394	0.08965	1.485946	0.026991
Question 46		5	0.052200	0.024658	4.481452	0.00387	0.100529	0.034265
have income		6	0.065372	0.304495	0.046092	-0.53143	0.662171	0.830008
Scale			1.000000	0.000000		1.00000	1.000000	

Sweetened bottle contents [Question 20], unassisted brushing [Question 38] and parental age [Question 46] showed a statistically significant association with ECC. Findings with the same conclusions were also found in the univariate analyses in chapter 4.

The odds ratios are represented in Table 6.2.2

Table 6.2.2: Odds ratios

any ECC - Odds Ratios (children logistic regression in results.stw) Distribution : BINOMIAL, Link function: LOGIT Modeled probability that any ECC = yes Include condition: "valid1"="yes"						
Effect	Level of Effect	Column	Odds Ratio	Lower CL 95.0%	Upper CL 95.0%	p
Intercept		1	0.608324	-1.84802	3.064668	0.691660
Question 20		2	3.159028	2.33953	3.978523	0.005940
Question 48		3	0.798084	0.39610	1.200065	0.271470
Question 38(Child)		4	2.198552	1.50040	2.896699	0.026991
Question 46		5	1.053587	1.00526	1.101916	0.034265
have income		6	1.067557	0.47076	1.664356	0.830008
Scale			1.000000			

Odds ratios showed that children who consume sweetened bottle contents [Question 20] were three times as likely to develop ECC. Children who brushed their teeth on their own [Question 38: unassisted brushing] had double the chance of developing caries. Findings with similar conclusions were also found in the univariate analyses in chapter 4.

Table 6.2.2 also illustrates that children of younger parents had a better oral health status. With every year increase in age of the parent, the likelihood of their children developing caries increases. In other words, children of older parents were at higher risk for caries development.

6.3 Discussion

The logistic regression analysis of the pooled data set yielded very few additional findings that were not already presented in the results of the individual univariate analyses in Chapters 3 to 5.

It was found in Chapter 4 that parental age was not significantly related to overall caries prevalence. In the present analysis, however, it was found that with increasing parental age the likelihood of children developing ECC increased. This may be attributed to older parents having more children thereby increasing the competition for available resources for e.g. a healthy diet and good oral care, while decreasing the time available to monitor each child's oral health.

The small yield of new information from the multivariate analysis lends support to the findings of the univariate analyses and thus the data analyses as represented in the individual sub-studies were deemed to be adequate. This multivariate support was achieved even though a portion of the children's data were omitted due to the absence of caregiver information.

6.4 References

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CHAPTER 7

PREVENTING EARLY CHILDHOOD CARIES IN THE PRIMARY HEALTH CARE SYSTEM-- A CALL TO ACTION

7.1 Introduction

The preceding three chapters uncovered some points of concern regarding the status of ECC in the study area. The practices and attitudes of the children's major caregivers showed that there are serious gaps in their knowledge and practices while the information gathered from the health care workers at major health service points in the area also pointed towards the need for education so as to improve their practices.

7.1.1 Brief review of major findings of Chapter 3 with emphasis on what needs to be done

The high caries prevalence of 71.6% found in this study attests to the fact that urgent interventions and collaboration of health care professionals from all sectors is needed to address this public health problem that has reached serious proportions in the Western Cape. Oral health matters should therefore be prioritized and incorporated into national health programmes.

The current prevalence of dental caries among young children has highlighted the need for a new approach to prevent caries by targeting younger children (Ramos-Gomez et al, 2010; Plutzer & Spencer, 2008; Bastos et al, 2008).

7.1.2 Brief review of major findings of Chapter 4 with emphasis on what needs to be done

7.1.2.1. FEEDING PRACTICES/ DIET

Parents need to be made aware of the erosive potential of certain beverages and be educated regarding appropriate sugar-free alternatives. Only 13 children in this study received pure water from the bottle. This practice should be encouraged to reduce the acidic pH of the oral environment especially before bedtime. The use of nursing bottles, sippy cups and sports drink bottles with sip-friendly caps should be discouraged, especially at bedtime.

Parents should strive to wean their children from the bottle and/ or breast by the age of 1 year.

Parents are largely responsible for their family's food choices. They therefore need to be targeted to bring about a positive change in the dietary habits of their family members. The benefits of healthier food choices need to be highlighted and that includes emphasis on improved oral health choices. Improved access to healthy foods would also influence overall food choices in a more positive way (Mobley et al, 2009).

Schools need to be more nutritionally aware. Basic nutrition information should be included in school curricula and healthy eating should actively be promoted (Bowley et al, 2007; Nicklas, 2003). Instilling the importance of good eating habits at a young age can only have positive long-term effects on society as a whole. In those schools where tuck shops are available or supplementary food schemes are operating, food choices should keep oral health in mind.

7.1.2.2. ORAL HYGIENE PRACTICES

The basis for effective and lasting oral hygiene habits is laid in the home during childhood. Education campaigns that focus on the parent-child relationship would most likely be more effective as the brushing techniques could be reinforced continuously as opposed to infrequent instructions received from health care providers (Sandström et al, 2011). Parents should also assist children to brush their teeth until the age of approximately 10 years (Sandström et al, 2011). Oral hygiene practices should be implemented at least once a day and especially last thing at night.

7.1.2.3. CAREGIVERS (PARENTS, GRANDPARENTS, TEACHERS)

Children who are looked after by day care staff during the day should not escape the oral hygiene safety net. Such staff members should therefore also be educated regarding optimal oral health of the children in their care. In addition, mothers and grandmothers in particular should be the focus of education campaigns as they are in close contact with the children and are also more likely to be the source of *Streptococcus mutans* transmission. Programmes should be put in place to reduce the levels of mutans streptococci in these caregivers (Prakash et al, 2012) and they should be educated on behavioural practices that would discourage transmission of these organisms.

7.1.2.4. TYPE OF DENTAL TREATMENT

In the present study it was found that extractions took place at a very young age with 40 of the children under the age of 4 years undergoing such treatment. This attests to the severity of the condition early in life and highlights the need to target this group of children in particular for intervention programmes. Emphasizing prevention, especially amongst these vulnerable children would therefore help to alleviate the need for more expensive treatment options at a later stage. Parents whose children are already affected by the disease should also be educated about the benefits of restoring their children's teeth.

7.1.3 Brief review of major findings of Chapter 5 with emphasis on what needs to be done

The American Academy of Pediatric Dentistry (AAPD guidelines, 2012-2013a) advises that all primary health care professionals learn about the aetiology and prevention of ECC. In addition to this, the Scottish Intercollegiate Guidelines Network (2005) also recommends that health care workers outside of dentistry should receive training on how to diagnose early signs of carious lesions. This training should be included in the curricula of 'all medical, nursing and allied health professional programs' (AAPD guidelines, 2012-2013b, p.128). In so-doing, health care workers would be empowered to recognize the early clinical signs of ECC so that these children can be referred for dental treatment timeously and potentially life-threatening situations like cellulitis can be prevented.

Health care professionals should also be able to give basic advice regarding feeding practices and diet and encourage parents to take their children for their first dental visit by the age of 12 months (AAPD guidelines, 2012-2013a). The Department of Health's 'Road to Health' booklet already makes provision for dental visits, so the importance of these dental check-ups should be emphasized. All moderate and high risk patients should be referred for an oral health assessment (AAPD guidelines, 2012-2013a). Medical practitioners should be made aware of the fact that children with asthma seem to be at greater risk of developing caries so that these children can be identified early and targeted for more intensive preventive measures. Long-term use of sweetened medications has also been linked to caries development (Kumarihamy et al, 2011) and parents should be informed of sugar-free alternatives that are available.

Pregnant mothers should also be targeted so as to raise awareness of the importance of oral health. Mothers should be made aware of the importance of their own oral hygiene in order to reduce the risk of transmission of *Streptococcus mutans* to their children.

7.2 Some important aspects relating to oral health policy

All countries try to provide the best affordable health care and support for their citizens that they can achieve and most have policies to enable the distribution of scarce resources optimally (U.S. Department of Health and Human Services, 2003; Petersen, 2009; WHO Regional Office for Africa, 2005). Oral diseases qualify as a major public health problem (Petersen, 2003) and the greatest burden of oral diseases fall on the disadvantaged and socially marginalized.

Since traditional treatment options (often involving surgery) are extremely costly and not feasible for developing countries, the WHO Global Oral Health Programme has been developed to improve oral health in resource-poor environments (Petersen, 2003). The basis for the WHO Global Oral Health Programme rests, among other things, on the following realities (Petersen, 2003):

- Oral health is vital and necessary for general health
- Oral health has a direct impact on the quality of life
- The association between oral health and general health is proven by evidence
- Proper oral health care reduces premature mortality through the early detection of disease

Four strategic directions were developed for the broad WHO framework that also have implications for the WHO Oral Health Programme: (Petersen, 2003, p.10)

1. 'Reducing the burden of oral disease and disability, especially in poor and marginalized people.
2. Promoting healthy lifestyles and reducing risk factors to oral health that arise from environmental, economic, social and behavioural causes.
3. Developing oral health systems that equitably improve oral health outcomes, respond to people's legitimate demands, and are financially fair.
4. Framing policies in oral health, based on integration of oral health into national and community health programmes, and promoting oral health as an effective dimension for development policy of society'.

The key socio-environmental factors involved in the promotion of oral health were set out as represented in Figure 7.2.1. These factors also indicated some important modifiable risk behaviours.

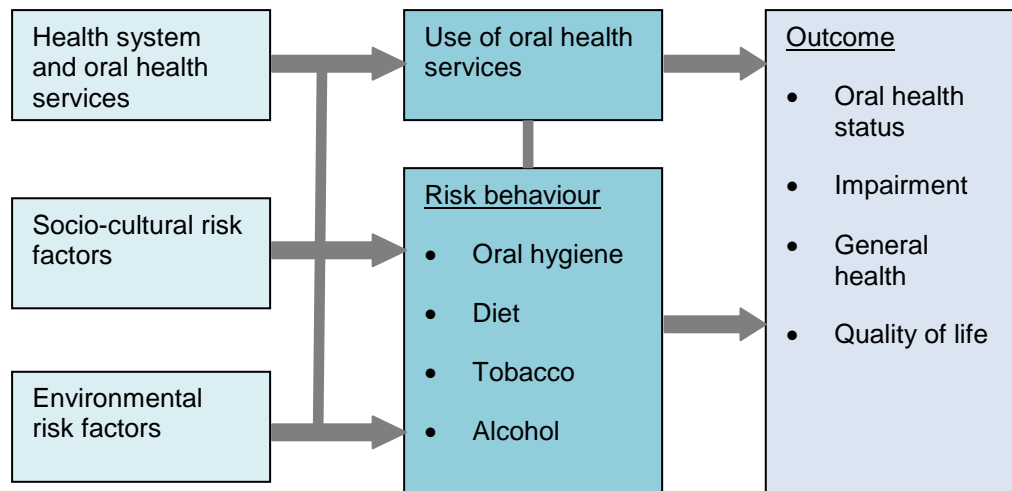


Figure 7.2.1: Risk factor approach to the promotion of oral health (adapted from Petersen, 2003, p. 11)

The United States of America launched a 'National Call to Action to Promote Oral Health' in 2003 (U.S. Department of Health and Human Services, 2003) after a report by the Surgeon-General highlighted a "silent epidemic of oral diseases [that] is affecting our most vulnerable citizens—poor children, the elderly, and many members of racial and ethnic minority groups" (U.S. Department of Health and Human Services, 2000, p.iii).

7.3 The status of global oral health policy

The WHO Global Oral Health Programme aimed to increase the worldwide awareness of oral health as an essential part of health and quality of life (Petersen, 2003). The reality is however that oral disease is increasing in prevalence in many low and middle income countries (Petersen, 2003).

The WHO Global Oral Health Programme (Petersen, 2009) formulated policies and activities needed to improve oral health. The major strategic approach was that the prevention of oral disease and promotional programmes to address oral health needs should be integrated with other general disease prevention strategies and health promotion as a whole.

This global policy forms the basis for future development or adjustment of oral health programmes at a national level. According to the Global Policy document (Petersen, 2009), clinical and public health research has shown that a number of individual, professional and community preventive measures are effective in preventing most oral diseases. Advances in oral health knowledge have not yet filtered through to the poor and disadvantaged populations in the developing world. The major challenges of the future will be to translate knowledge and experiences in oral disease prevention and health promotion into action (Petersen, 2009).

The global policy document directed an open invitation to the oral health research community to expand research into the fields of oral health as well as to strengthen the research capacity especially in the developing countries. The objective is to make research a central component of oral health policy across the world.

The National Maternal and Child Health Oral Health Policy Center of the United States of America (2010) summarized the opportunities for the prevention of ECC through implementation of health care reform. Some of the policy solutions relevant to South Africa that are presented in this document are:

1. Opportunities should be turned into action- funding of appropriate programmes should be encouraged.
2. New central government grants should be encouraged and strategies should be developed that will put health care services in a position to apply for those funds as they become available.
3. Oral health should be integrated across all new health promotion programmes and coordinated with or integrated into comprehensive health care systems.
4. Community-based and even school-based health care programmes should include dental services. This includes an active promotion of the integration of privately practicing dentists and state health services.
5. Effective partnerships should be developed. Important advocacy groups and service organisations should be assimilated (formally or informally) into an effective care network to ensure that oral health is a core component of health care reform implementation at the state and local level.
6. State oral health services should be strengthened so that they can be empowered to coordinate, integrate, and promote oral health actions.

The National Maternal and Child Health Oral Health Policy Center (2010) presented their approach in the following scheme which may be of considerable use to the South African situation:

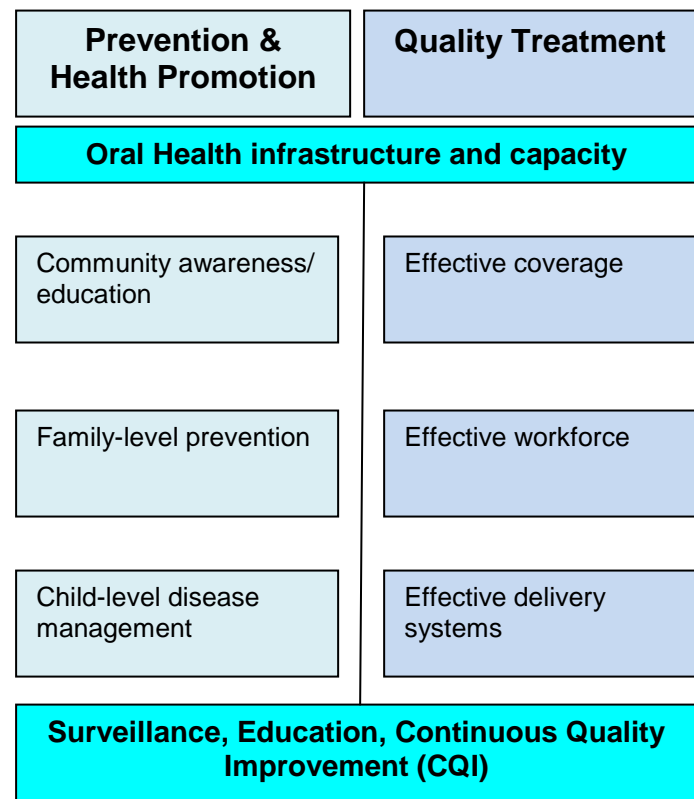


Figure 7.3.1: Approach to improve and strengthen oral health actions (National Maternal and Child Oral Health Policy Center, 2010, p.3)

7.4 The status of oral health policy in South Africa

The National Children's Oral Health Survey 1999–2002 (Van Wyk & Van Wyk, 2004) provided the most recent and comprehensive epidemiological information on the prevalence and severity of oral diseases in South Africa. Even after 6 years, the data generated by this survey has been used as a basis for articles (Postma et al, 2008). To date, no new comprehensive data on this condition have been gathered and all planning is based on the data that are by now more than a decade old. In South Africa, there is a paucity of relevant, updated data regarding the caries status of the population.

The National Children's Oral Health Survey showed that there are serious problems regarding oral health in the country - a viewpoint supported by the findings of the present

study. The problems revealed by this national survey prompted Singh et al (2010) to review the policies regarding oral health care in South Africa. They drew information from a wide array of policy documents, protocols, treatment plans and also conducted interviews. They found that the results indicate distinct contradictions between the policy formulation process and its impact on health system decision-making. South African health policy was found to be strong on the rhetoric of equity, health promotion, integration and several other features of the Primary Health Care Approach, but showed little evidence of translating this into action.

According to Singh et al (2010) the development and implementation of oral health promotion appears to be dominated by the influence of dental professionals who perpetuate a curative focus on service delivery. There is an urgent need to re-examine the process and content of oral health policy-making in South Africa. The authors felt that the epidemiological characteristics of oral disease (e.g. prevalence, distribution and impact) coupled with imbalances in available care, supported the need for a coherent oral health policy. This viewpoint by Singh et al (2010) is supported by the high prevalence of ECC and lack of community-based prevention strategies found in the present study.

Analysis of the Department of Health's Annual Performance Plan for 2011/ 2012 revealed that ECC is not a priority in the Western Cape. The only 'childhood illnesses of concern' listed were 'malnutrition, diarrhoeal disease and respiratory illness' (p. 20). The Province's plan to improve wellness involves increasing life-expectancy, lowering maternal and child mortality rates, combating HIV and reducing the incidence of TB. No mention was made of ECC and its effect on "wellness" (Department of Health, 2011/ 2012). The Strategic Planning Framework for 2020 on the other hand, mentioned the need for an improved infrastructure for the provision of dental services but there were no clear proposals as to how it will be implemented (Strategic Planning Framework, 2011).

7.5 Analysis of the South African National Oral Health Strategy and the Comprehensive Oral Health Service Plan (COHSP)

The South African National Oral Health Strategy stipulated national goals for 2010. It was envisioned that by 2010, the following would be in place:

- The number of public health care facilities providing oral health care especially at district hospitals and community health centres would be increased. There would also be more mobile dental units to improve access to oral health care services.

- The WHO goals for 2010 would be met by ensuring that 50% of 6-year-old children were caries free and by reducing the number of decayed, missing and filled teeth in 12-year-olds to 1.0.
- 60% of the population would have access to fluoridated water.
- All clinics would offer a “primary oral health care package”. The ‘minimum oral health package’ involves the provision of basic services such as an examination, bitewing radiographs, scaling and polishing, provision of simple 1-to-3-surface restorations and emergency relief of pain and sepsis (p.41).

The Comprehensive Oral Health Service Plan (COHSP) was based on the South African National Oral Health Strategy and was signed by the Provincial Minister of Health in 2007 in a bid to revamp the oral health services so as to meet the healthcare goals for 2010. It was intended to be used as a guide for allocating resources and implementing oral health programmes.

Addressing early childhood caries and managing caries in the primary and permanent dentitions were identified as primary concerns. Oral health promotion targeting mothers and children, brushing and rinsing programmes at schools and placement of fissure sealants were suggested as a means to address the problem of dental caries. These suggestions were based on data obtained from National Oral Health surveys in 1988, 1989 and 2003. This showed that, in the last 20 years, not much progress has been made in terms of managing this problem. It is also clear that, to date, none of the national goals for 2010, have been met.

Aggressive prevention campaigns focusing on the health of mothers and their children were proposed yet, at present, no such programmes exist in the communities and well-baby clinics included in this study. Nurses at these clinics were ill-informed regarding oral hygiene, bottle- and breastfeeding practices and diet. In order to equip mothers with this necessary information, health care providers need to be informed so that they can actively engage parents and assist them in making the right decisions where the oral health of their children are concerned.

Dental screening of infants at 9 and 18 months of age was also suggested and as recommended, provision has been made to record these appointments in ‘The Road to Health Chart’. It has been recommended that this section of the booklet be completed by oral hygienists, dentists or dental therapists. However, referring these patients to a dental clinic

or tertiary institution to be screened is impractical. This section of the 'Road to Health' chart is therefore often not completed. Taking a child for a dental check-up is an added expense that many of these parents can ill afford, especially in the initial stages when caries might not be as obvious. Early screening would therefore be more effective if it could be incorporated into the well-baby visits. But, once again, health care workers need to be trained to identify potential dental problems. Investing in the training of health care professionals regarding oral health and focusing on prevention of oral disease, would lead to a greater cost savings at a later stage.

Water fluoridation was touted as a cost-effective way to reduce caries prevalence (Griffin et al, 2001). This has still not been implemented in South Africa and the need for water fluoridation should possibly be re-evaluated in light of the fact that fluoride-containing toothpastes and other products are readily available. The effectiveness of and need for systemic fluorides in the presence of topical fluorides has recently been questioned (Hellwig & Lennon, 2004). It is thought that systemic fluorides provide no additional benefit (Hellwig & Lennon, 2004). Brushing programmes at schools and the provision of fluoridated toothpaste would therefore most likely be more beneficial (Yazdani et al, 2009).

Targeting Grade 1 learners to have their permanent molars sealed is not so easy to put into practice as these children have to be transported to a clinic or facility to have the fissure sealants placed. Even if it was possible to provide this service at mobile clinics, this initiative would still need a considerable investment of manpower and resources. It would seem that the current focus of the proposed service plan is to invest in the permanent dentition as 'younger children will lose their primary teeth eventually' (p. 42). It would however make more sense to invest in the preservation of the primary dentition as early extractions lead to malocclusions. The COHSP document also mentions that, '30 to 40% of 12-year-olds need definitive orthodontic treatment' (p. 38). Investing in prevention and the preservation of the primary teeth would therefore make more sound economic sense. Establishing good habits early would also result in a healthier permanent dentition.

It was envisioned that primary oral health services would account for 90% of the service delivery with tertiary institutions only providing 2% of care. With the present huge demand for general anaesthesia services and the low number of community dental clinics that are also ill-equipped and unable to provide basic restorative care, the waiting lists at tertiary institutions like the Tygerberg Oral Health Centre are overflowing and cannot cope with this

demand. There is therefore a need to increase the number of facilities that are able to provide this service, especially in the rural areas.

Many of the paediatric patients are referred to tertiary institutions, often in another province, where there are no facilities to treat these patients closer to home. More state funds need to be invested in upgrading facilities to cope with the unmet treatment need. At present, community dental clinics almost exclusively provide only an emergency extraction service. By improving the services that primary health care clinics are able to provide such as the inclusion of preventive and restorative services, the numbers of referrals to tertiary institutions would be reduced and waiting lists would be alleviated.

The Comprehensive Oral Health Service Plan has put forward ideas that are for the most part, still to be implemented. Even though this proposal (compiled by Prof. A.J. Louw at the University of the Western Cape) was signed by the Minister of Health in 2007, it has not been formally accepted or published [Department of Health (South Africa). *Comprehensive Oral Health Service Plan (COHSP) for the implementation of healthcare 2010*. Unpublished document obtained from Prof A. J. Louw, Department of Community Dentistry, University of the Western Cape.] At present, there is a lack of communication between the policy makers and the staff who have to implement these policies. All health care professionals need to be actively engaged across all disciplines and all spheres of healthcare if the proposals in this plan are to be realized.

7.6 Brief overview of relevant principles and practices of oral health promotion

7.6.1 General Education Campaigns

Health education campaigns are intended to emphasize prevention, thereby reducing costs and lessening the need for more invasive treatment further down the line (Kay & Locker, 1996). The Scottish Intercollegiate Guidelines Network (2005) especially recommends targeting families from deprived areas as these individuals are at increased risk of developing ECC.

Preventive strategies should target high risk communities and focus on all the risk factors implicated in the disease process (Scottish Intercollegiate Guidelines Network, 2005). Preventive programmes should also include information on the disease characteristics and progression as well as associated complications of the disease and challenges of treatment (Păsăreanu, 2007).

Cultural barriers can play a role in the success of education campaigns (Reinhardt et al, 2009; Wennhall et al, 2008) and cultural differences between communities should also be taken into consideration when developing educational material. What works for one community might not necessarily be effective for another. When it comes to oral health, good parental role models are lacking (Reinhardt et al, 2009) and some parents have the deeply ingrained belief that primary teeth are of a temporary nature and are going to fall out anyway (Rothe et al, 2010). Thus, treatment for carious lesions in the primary dentition is often not sought.

In order to educate parents, one must be familiar with their existing knowledge on a particular health topic, as well as their beliefs and practices. By focusing on parental beliefs and understanding the reasons why parents or caregivers behave in a certain manner, it may be possible to get to the root of the problem and put systems in place which will help implement behaviour change.

Interventions that target the health of the family are generally directed towards parents/caregivers (Brown et al, 2006). These interventions should not only provide parents/caregivers with information so that they understand the importance of oral health but should also empower them to develop skills enabling them to improve their own oral health as well as that of their children (Watt & Fuller, 1999). If sufficiently well entrenched, this in turn should lead to the adoption of a healthier lifestyle and a positive change in behaviour (Kay & Locker, 1996).

Behaviour change is especially difficult when it comes to the implementation of improved oral hygiene and dietary habits (Rothe et al, 2010). Where dental health education has been shown to improve behaviour to a certain degree, these improvements were not significant and were only effective for a short period of time (Kay & Locker, 1996; Watt & Fuller, 1999). Changing attitudes in the long term proves to be more challenging as people are usually resistant to changing well-established habits and practices (Kay & Locker, 1996).

The term 'anticipatory guidance' is often used in the literature and involves providing caregivers and parents with information so that potential problems at different stages of the child's development can be 'anticipated' and prevented (definition adapted from <http://www.smilebugg.com/pediatric-dentistry-wenatchee-wa/anticipatory-guidance.aspx>)

Motivational interviewing has also been used to effect positive behaviour change and has been associated with reduced caries incidence (Plutzer & Spencer, 2008; Weinstein et al, 2006). Rollnick and Miller (1995) defined motivational interviewing as 'a directive, client-centered counseling style for eliciting behaviour change by helping clients explore and resolve ambivalence' (p. 325). In other words, the interviewer facilitates a one-on-one discussion and provides information that will help to resolve any ambivalence by weighing up the pros and cons of each situation. The facilitator/ counselor then steers the participant in a positive direction which would hopefully trigger behaviour change. It does not involve 'persuasion' on the part of the counselor but rather, the counselor is merely there to resolve or clarify issues so that the client can make an informed choice. The desire of the client to change existing behavioural patterns is entirely self-motivated (Rollnick & Miller, 1995).

Motivational interviewing has been shown to evoke positive changes in behaviour and should be considered as a means to modify parental behaviour. Follow-up is however essential. Empathy for parental circumstances would most likely result in a more favourable outcome in terms of behaviour change.

Actively engaging the mothers and establishing relationships with them by taking an interest in their situations can greatly improve the long-term success of health promotion programmes (Plutzer & Spencer, 2008). This in turn may result in a reduced caries prevalence in the children of these parents (Tinanoff & Reisine, 2009). Differences in culture and beliefs should be taken into consideration and addressed with the necessary sensitivity.

According to Blinkhorn (1983), there is a 'lack of information on the many social factors which influence the implementation of dental health education programmes' (p. 503). It is essential for oral health promotion initiatives to take into consideration that external factors may impact on behaviour. These factors are complex and can include things like whether or not individuals have access to healthy foods or fluoride as well as how they perceive healthy lifestyle choices (Watt & Fuller, 1999). It is therefore important to understand the patient's perspective and consider various aspects of their everyday lives when imparting information. Patients are more likely to comply with advice that has been personalized and tailored to their individual needs (Watt & Fuller, 1999). The information imparted should also be based on the existing level of knowledge. Caregivers should be given enough information to help them make informed decisions. It might also be possible to make a greater impact on behaviour change by addressing issues parents are interested in (Rothe et al, 2010).

Parents should be taught how to incorporate 'caries-protective behaviours' into their daily routine and reduce the frequency of high risk, 'caries-promoting behaviour' (Blair et al, 2006). Greater benefit can be derived from promotion programmes that include other family members such as grandparents. This would also help to unify families in their approach and eliminate tension which could arise from differing opinions on child-rearing (Plutzer & Spencer, 2008).

Getting the message across

The message should ideally be communicated in the patient's mother tongue (Brown et al, 2006) and should be delivered piecemeal. Too much information at one time makes people unreceptive. Programmes need to be tailored to the needs of the community and this could prove to be a costly and time-consuming exercise (Brown et al, 2006). Advice should be practical and be easy to put into practice. Simple, 'jargon-free' language should be used (Blair et al, 2006).

Dental health education initiatives have targeted patients in the dental setting, in the workplace, schools and daycare (Kay & Locker, 1996). Different methods have been used to convey educational oral health messages. These include oral messages, printed leaflets, slide shows and audiovisual aids (Kay & Locker, 1996; Rothe et al, 2010; Plutzer & Spencer, 2008). Other suggested methods for getting the educational message across include manuals, counseling and posters (Păsăreanu, 2007). It is important that these messages are relevant to the communities that are being targeted (Scottish Intercollegiate Guidelines Network, 2005). Literacy levels should also be taken into consideration. People respond differently to various teaching aids. Where the use of slide presentations may be effective amongst certain individuals, others might respond better to hands-on demonstrations (Rothe et al, 2010).

Yazdani et al (2009) used leaflets and video tapes as a means to educate their study population of adolescents. Results of this study showed that participants who received leaflets had a greater improvement in oral hygiene than those that viewed an educational video. It is speculated that one of the reasons for this was that individuals who received the leaflet each had their own copy which could be re-read as opposed to the video which was only viewed twice. Males and females also responded differently to various communication tools and this should be taken into consideration when planning an intervention strategy (Yazdani et al, 2009).

Rothe et al (2010) demonstrated that a 30 minute slide and video presentation was effective in improving parents' knowledge regarding oral health and caring for their children's teeth. A concise presentation and video was produced at a third grade reading and comprehension level. Parents then attended a one-hour presentation session. They also received 'a folder containing information on infant oral health, an infant and adult toothbrush, infant toothpaste and a 10 dollar gift card' as incentive (p.38). Parental dental knowledge was assessed prior to and after the presentation. There was a marked improvement in scores after the presentation was viewed and parents commented that the information 'would change the way they cared for their children's teeth' (p.41). These presentations can reach many individuals and in homes where there is more than one child per family, all children can benefit from the information made available.

The key to successful education programmes is repetition (Meurman et al, 2009). Plutzer and Spencer (2008) had a good success rate by repeating information at various intervals. They also found that the non-intrusive method of distributing pamphlets via mail contributed to the higher level of participation especially amongst women with lower levels of education. Mothers with lower education levels were more eager to improve their knowledge, thereby improving their parenting skills. More educated mothers were more likely to feel that they benefited less from the intervention.

Mailing the pamphlets allowed mothers to examine the information in their own time and made the sharing of information easier (Plutzer & Spencer, 2008). Mothers could also review it repeatedly as needed. Pamphlets were well received. However, follow-up telephonic consultations which were meant to reinforce behaviour change was seen by participants as a disruption and were therefore ineffective (Plutzer & Spencer, 2008). For mailed pamphlets to be successful the recipient population will have to be able to read at the level of the text on the pamphlet.

Interventions from the literature

Plutzer and Spencer (2008) tested the efficacy of an oral health promotion programme introduced during pregnancy. Information was provided to first-time mothers so that proper oral health habits could be established prior to the birth of the child. This was reinforced at 6 months and 12 months after the birth of the child. Anticipatory guidance provided during pregnancy and repeated at set intervals after the birth of the child, proved to be successful and resulted in a reduced incidence of s-ECC. The authors suggested that antenatal clinics of public hospitals would be an appropriate setting to target these expectant mothers. They

found that these first-time mothers' inexperience with child-rearing practices made them ideal targets for the dissemination of these information pamphlets as they were generally more receptive.

Information sessions at places outside the dental surgery such as community clinics are more cost effective and more people, especially high risk individuals, can be reached. This is especially important in communities where children rarely experience asymptomatic dental visits and where oral hygiene practices from an early age are not a priority (Blair et al, 2006). Delivering the same message in a dental surgery is more time-consuming as clinical procedures take precedence over messages about prevention (Pienihäkkinen et al, 2005; Meurman et al, 2009). In the Nordic countries, parents are required to report to these public health care facilities, regardless of their social background (Meurman et al, 2009).

Wennhall et al (2008) conducted their study from an outreach facility located at a local shopping centre. The reasoning behind this was to provide an 'accessible point of contact' which was not directly associated with a public dental service. Attendance was therefore likely to be better. Children were enrolled in the programme and recalled at regular intervals to assess their oral health. Parents were given tooth brushing instructions and advised about diet. They also received free fluoride supplements which had to be administered to their children in a specific dose as determined by the examiner. This intervention spanned 3 years and resulted in a reduction in caries prevalence amongst the study population but the effectiveness of the intervention decreased over time.

Dental caries in preschool children can be reduced by targeting individuals at high risk of developing caries through oral health programmes at health care facilities (Meurman et al, 2009). The focus of these programmes should be the establishment of good oral habits from birth and early education of caregivers regarding the transmission of mutans streptococci. In a study by Meurman et al (2009), a team approach was adopted. The team consisted of nurses, dentists and oral hygienists. The nurses were responsible for making parents aware of general health issues as well as certain aspects of oral health. The importance of good oral health especially during and after pregnancy was stressed. Use of xylitol was encouraged amongst pregnant women to decrease the risk of transmission of *Streptococcus mutans*. After birth, caregivers were informed about healthy food choices, the benefits of fluoride and how to prevent the transmission of mutans streptococci from mother to child. They were also shown how to care for their child's teeth. All information imparted was made available in written format as well (Meurman et al, 2009).

Children were followed up at regular intervals from birth, with the final visit at the age of 5 years. During this period, parents received free toothbrushes and xylitol lozenges and children were subjected to a dental examination at least twice during this time period. This programme showed that early intervention reduced the risk of caries especially in white-collar families. These interventions however did not reduce the caries incidence amongst low-income families and the authors stressed that a different approach might be needed when targeting this particular sector of the population (Meurman et al, 2009).

Incentives

Participants are more likely to act on an educational message if tangible benefits can be recognized. In their study, Yazdani et al (2009) emphasized that good oral health could lead to benefits such as fresh breath, whiter and brighter teeth or a more attractive appearance.

Widespread distribution of free fluoride toothpaste was one of the components responsible for the success for the oral health programme reported by Blair et al (2006). Plutzer and Spencer (2008) provided mouth rinses, finger toothbrushes and toothbrushes for the mothers themselves as incentives for participating in their study.

Target audience

Interventions should not only target individuals and communities but also all individuals serving these communities (Watt & Fuller, 1999). Training dental and non-dental providers should enable them to provide information and services to parents of children affected by ECC (Brown et al, 2006).

Yazdani et al (2009) questioned whether dental professionals sufficiently emphasize preventive care. Dentists are often not remunerated for preventive services and therefore tend to neglect this time-consuming task in favour of quicker clinical procedures which are more financially rewarding. Medical aid schemes usually do not cover the services that are needed to prevent or treat ECC and for many of these medical aid schemes, reimbursement rates for treating children are low. For this reason, practitioners may be reluctant to accept children as patients (Brown et al, 2006). Providing an incentive by compensating practitioners financially for preventive visits, could therefore help spread the message of prevention (Watt & Fuller, 1999). Another issue is that some dentists feel ill-equipped to treat children especially infants and toddlers. Providing them with the necessary skills to assist them in handling these children appropriately will boost their confidence and improve the quality of service they provide (Brown et al, 2006).

On the other hand, collaborative efforts with other health professionals such as doctors, nurses and pharmacists would ensure that more individuals are reached and it would serve to promote better oral health with a resultant improvement in general health and well-being (Watt & Fuller, 1999). Paediatricians and nurses deal with children from a young age and are in a position to provide information and refer children for oral health screening early on (Brown et al, 2006). By breaking down barriers and improving communication between the various health professions, the effectiveness of ECC intervention programmes could essentially be improved (Brown et al, 2006). More oral health messages also need to be included in existing health promotion messages and be integrated into child health and development systems (Chisick et al, 2000; Brown et al, 2006). Of utmost importance is that all health care services speak with one voice and disseminate the same information. Conflicting information causes confusion and creates the impression that the message being imparted is not credible (Watt & Fuller, 1999). Hence, these campaigns are bound to fail. Effective health education is therefore dependant on good team work (Watt & Fuller, 1999). The team approach was substantiated by Blair et al's study (2006) where Oral Health Action Teams were used to get the message across.

Teachers (Watt & Fuller, 1999) and caregivers who come into contact with children should also be targeted. The Scottish Intercollegiate Guidelines Network (2005) stated the following: 'Teachers, community workers and lay or peer educators can be effective in delivering health promotion interventions and their role should be considered in the development of oral health promotion programmes' (p.21). Schools provide the ideal setting for introducing programmes to promote oral health. It has been advised that oral health and tooth brushing programmes be introduced at nurseries especially before three years of age (Scottish Intercollegiate Guidelines Network, 2005). Reinhart et al (2009) introduced a peer teaching programme where fourth graders assisted first grade pupils with brushing. Underprivileged and migrant populations were targeted. The language barrier between oral health educators in this particular community posed a problem. This programme therefore served to bridge this gap by providing oral hygiene instructions in the first graders' mother tongue, thereby resulting in improved oral health amongst the younger children.

In order for interventions to be successful, health promoters should be cognizant of the fact that changing existing behaviours is not easy. They should be supportive and encouraging so that patients are motivated to persist with their efforts (Watt & Fuller, 1999). A supportive environment also needs to be created which will enable individuals to change existing ingrained habits and practice what they have learnt (Watt & Fuller, 1999). This environment

should make it easy for them to continue with positive behaviours such as incorporating sugar-free foods into their diet. By reducing costs and improving accessibility to these foodstuffs especially at school, work and places of recreation, adoption of healthier lifestyles can be encouraged through the creation of healthy environments (Watt & Fuller, 1999).

These initiatives which target the general public undoubtedly require support from government, health authorities and policy makers (Meurman et al, 2009; AAPD guidelines, 2012-2013a). Awareness should be raised regarding the extent of the problem so that preventive services can be made a priority and programmes can be put in place to address the issue (Brown et al, 2006). It will also require a substantial investment of time, labour and finances (Kay & Locker, 1996). ECC is not just a dental issue but a public health issue. By pooling resources, greater strides can be made towards reducing the prevalence of ECC (Brown et al, 2006).

According to Watt and Fuller (1999), 'healthy public policy, supportive environments and public participation are essential elements of effective oral health promotion' (p.6). Programmes should be evaluated regularly to ascertain their effectiveness and should be modified according to the needs of the community (Yazdani et al, 2009).

7.6.2 Implementation of Oral Health Promotion Campaigns in the study population

Communities need to be educated regarding the causes of ECC and how it can be prevented. They need to be made aware of acceptable behaviours that will help reduce the prevalence of the disease. Parents and/ or caregivers are more likely to comply with the message conveyed in education campaigns and seek treatment for their children if it is easy to do so.

A successful education campaign involves input and assistance from various parties. In order to target caregivers and their children, input is needed from professionals that have contact with children. These include primary health care professionals such as doctors and nurses as well as school teachers, nannies and caregivers at crechés. Clinics and schools provide the ideal setting to identify children in need of treatment. These professionals should be used to get the information across to parents and other caregivers in the broader community.

Health professionals and teachers should be in a position to identify children at risk for developing ECC as well as those that require treatment. An effective referral system should then be established with dental professionals. At present, there are no structured preventive

programmes at any of the community clinics included in this study. Even though nurses claim to have been taught about prevention and feeding practices in their undergraduate curriculum, parents visiting these clinics claim that nurses do not educate them on these preventive aspects.

If all children across all communities have to be vaccinated at community immunization clinics, health care workers at these facilities could play an invaluable role in the prevention of ECC, the identification of caries in vulnerable children and the provision of information to young mothers regarding appropriate feeding practices. The most vulnerable age group was shown to be the 3 years to 3-year-11-month category. These children are not at school yet but would definitely come into contact with health professionals or even nannies and staff at crèches or daycare. In older children, teachers would play an important role in identifying children in need of more advanced dental care.

Dental professionals have a duty to support these professionals in terms of providing information on how to combat ECC, training them in the identification of the disease process and treating patients that are referred for dental treatment. Dental treatment should be accessible to all children and dental professionals should be equipped to provide them with any type of preventive, restorative and emergency care. Free dental treatment (especially for children under the age of 6 years) at all facilities providing dental care for children (including tertiary institutions) would be an incentive for parents to seek dental treatment. At present, tertiary institutions like the TOHC charge patients based on their level of income. This will be discussed again later in the chapter.

Community dental clinics need to be equipped for more preventive and restorative care and should not provide a purely emergency extraction service. For dentists in the private sector, medical aid reimbursement for dental procedures including prevention would serve as an incentive to engage in more conservative dental procedures and spread the message of prevention. A culture of regular dental attendance and emphasis on the benefits thereof should be encouraged.

With an increase in the number of expected referrals, an increase in manpower is also needed to service these patients. This could be addressed by creating community service posts for newly-qualified oral hygienists and additional posts for dentists who have completed their community service.

The campaign to involve the health professions in the fight against ECC should be widespread and be rolled out on a national level. All parties involved in the campaign should be clear on the plan of action.

The high prevalence of ECC in the communities serviced by the Tygerberg Oral Health Centre is the driving force behind the education campaign. Caries is a behaviour-driven disease. Parents and caregivers should therefore be targeted as changing negative behaviour is the most important step in combatting this disease. An awareness should be created where the causes of ECC as well as the benefits of changing negative behaviour are emphasized.

In the case of ECC, it should be emphasized that positive behaviour change and the prevention of ECC could result in the following benefits:

- Better oral health which leads to improved general health
- Prevention of pain and sepsis which leads to an improved quality of life. Problems associated with pain include sleep disturbances and a lack of appetite with resulting nutritional deficiencies. These can be avoided if oral health is improved.
- Healthy, white teeth. This should be the accepted norm. Poor dental health and caries with resultant extractions and unaesthetic appearance could lead to the development of psychological and speech problems in young children as these children are often teased about their appearance.
- On a personal level, expenses incurred for dental treatment would be reduced. In turn, the reduced burden placed on the general anaesthesia and sedation services will also lead to a considerable cost savings and reduce the need to tap into government resources.

In children already affected by the disease, caregivers should be informed that it is never too late to change behaviour and see positive results. The negative mindset regarding fillings and dental treatment that permeates this community needs to be changed. Misconceptions e.g. fillings causing bad breath, should also be addressed. Traditional norms may be perceived as a barrier to behaviour change e.g. a community which is renowned for having their four upper anterior teeth extracted would not place much value on saving carious teeth.

The benefits of having carious teeth restored such as the prevention of future, more expensive orthodontic treatment need to be emphasized. It is important to understand why communities/ caregivers behave in a certain manner so that the motivation behind their

behaviour can be identified. The gaps in their knowledge should also be targeted. In so doing, the needs of the community can be identified. The benefit of the action should outweigh the effort required to comply.

The bottle is often used as a means of behaviour control where it is just easier to relent and give in to a child's demand for a night-time bottle rather than trying to pacify the child by other means. These children come from homes where money is tight and there are other social stresses taking up their parents' time. Feeding and oral hygiene practises are therefore low on the list of priorities. These stresses could be barriers to behaviour change. Introducing a regular oral hygiene regimen might also be perceived as an additional expense. This could perhaps be addressed on a government level with the provision of free toothbrushes and toothpaste to children up to a certain age. Thereafter, affordable toothpaste, free check-ups, free dental advice and screening etc. can be provided. Providing this kind of incentive would help to encourage behaviour change by making oral hygiene aids more readily available and eventually lead to the establishment of better habits and new social norms.

Knowledge alone is not enough to change behaviour. The short-term inconvenience of cleaning their child's teeth after feeds should be weighed against what could happen if their behaviour remains unchanged i.e. the development of caries which would require some sort of intervention and could be expensive. If left to deteriorate further, pain can result in sleepless nights for the child and their parents and leave them functioning less than optimally. Sometimes, compromise is necessary e.g. it might not be possible to eliminate all sugar from the diet but it is possible to limit the sugar consumption to mealtimes or rinse the mouth out after sugary products have been consumed.

Caregivers might also be unaware of the impact of their behaviour on their child's dental health e.g. in this study, in excess of 70% of parents were unaware that sharing utensils with their children could spread cavities between parent and child. Young children brushing their own teeth could be seen as an accomplishment on the part of the parent and something to be proud of. Yet, these parents are unaware that children only develop the dexterity to brush their teeth adequately at around 10 years of age and that up until that time, the primary responsibility for the child's oral hygiene rests with the parents.

Getting the message across in the study population

As many of the caregivers in this community are not educated, it should be borne in mind that pamphlets and reading material provided on ECC might not be the most effective way to

get the message of prevention across. Visual aids including illustrations, posters and videos may be of greater benefit. Information sessions at public places or events frequented by the community and advertisements in popular community tabloids could be considered as a means of getting the message across.

Focusing on changing too many different behaviours at once can be confusing. The emphasis should therefore be placed on the message that will have the most impact on behaviour change. It will more likely be remembered if it is repeated often. Printed information leaflets that are distributed throughout the community are ideal for referring to time and again and should be such that it does not become outdated quickly.

Parents in these communities who have succeeded in combating caries in their children could be used as role models and encourage other parents to follow suit by sharing their experiences. Respected members of the community could also be approached to get involved and spread the message of prevention.

It is important that the message is delivered in familiar, simple, everyday language that is easy to understand. The instructions should be clear and specific. It should provide information and suggestions on what is acceptable behaviour. By understanding why certain behaviours are acceptable or unacceptable, caregivers may be more likely to comply. Reasons for suggested behaviour change therefore need to be provided.

The following section will focus on relevant content that needs to be included in these education campaigns which should be widespread and target all sectors of the population.

7.7 CORE MESSAGE/ ADVICE TO COMBAT ECC

7.7.1 CAREGIVERS - information needed to inform caregivers (pictures/ illustrations will be added as indicated)

Spreading of germs between individuals

For children of all ages the following information should be shared with all caregivers:

Basic message:

- Dental decay can spread between individuals

Advice:

- Do not share spoons or any eating utensils
- Do not taste your baby's food and feed them with the same spoon
- Do not share toothbrushes
- Soak toothbrushes overnight in a mug of water containing a teaspoon of household bleach e.g. Jik, Domestos, Milton. Take GREAT care to prevent children from drinking this water!

Feeding of children

Basic messages:

- Dental decay can spread between individuals
- All food (especially those with sugar) that clings to the teeth can cause tooth decay
- Milk contains a lot of sugar - especially breast milk
- Sweetened drinks also have a very bad effect on teeth

Advice:

- No sweet liquids in bottle
- Do not dip dummy in sugar or honey
- Stop breast- and bottle-feeding by 1 year
- After meals, if teeth cannot be brushed, rinse child's mouth or give water to drink

Age range: infants

Motivation:

After one year of age, feeding habits are more difficult to break.

Children can drink out of a cup or mug from one year of age

Advice:

Stop breast- and bottle-feeding by 1 year

Recommended illustration/ s:

Cup/ mug—illustrate with a ✓

Age range: children of all ages

Motivation:

All food (especially those with sugar) that clings to the teeth can cause tooth decay

Bottle tips/ teats deposit substances directly onto the teeth

Advice:

Drink out of a cup or a use straw. ✓

No sippy cups or sports bottles. X

Recommended illustration/s:

Mug with a straw-- illustrate with a ✓

Sippy cup-- illustration covered with an X

Sports bottle-- illustration covered with an X

Cross-sectional view of the mouth showing the teat of the bottle in contact with the upper teeth

Oral hygiene practices (Targeting parents/ caregivers)

Age range: infants

Motivation:

Dental decay is caused by bacteria on the tooth surface

Advice:

Remove bacteria from the tooth surface

In children younger than 18 months, clean the child's mouth after feeds using gauze, cloth or soft children's toothbrush

From 2 years of age, use a soft children's toothbrush and children's toothpaste to clean the child's teeth.

After meals, if teeth cannot be brushed, rinse child's mouth or let them drink water

Recommended illustration/s:

Toothbrush with a smear of toothpaste applied in the breadth of the toothbrush

Glass of water—illustrate with a ✓

Age range: infants

Motivation:

The things that cause dental decay are worse at night

Advice:

Remove bacteria from the tooth surface

Clean the child's mouth before the child goes to sleep

Do not give the child a bottle to drink at night

Recommended illustration/ s:

Child sleeping with bottle in the mouth—cover illustration with an X

Toothbrush with a smear of toothpaste applied in the breadth of the toothbrush

Age range: infants

Motivation:

Young children cannot spit

Children will swallow the toothpaste

Swallowing too much toothpaste can cause spots on the teeth.

Advice:

In children younger than 18 months, do not use toothpaste

From 2 years of age, use a soft children's toothbrush and children's toothpaste to clean the child's teeth.

Recommended illustration/ s:

Toothbrush with a smear of toothpaste applied in the breadth of the toothbrush

Age range: children 2 to 5 years of age

Motivation:

Dental decay is caused by bacteria of the tooth surface

Children cannot brush their teeth properly until they are about 10 years old

Advice:

Parents must help children to brush their teeth

After meals, if teeth cannot be brushed, child should rinse the mouth or drink water

Recommended illustration/s:

Parent standing behind the child, child's head is tilted upwards, parent is assisting child with tooth brushing

7.7.2 NURSING PROFESSIONALS (In the form of treatment protocols and pamphlets - an information file) - pictures/ illustrations will be added as indicated in brackets.

From the foregoing research study, the following are identified as basic minimum knowledge for inclusion in the curricula of nursing and other health care professionals.

How to perform an oral examination

- Lift-the-lip technique (add picture)
- Identification of caries (add pictures)
- Identification of abscesses and other soft tissue lesions (add pictures)
- How to perform an oral exam—what to look out for (abscesses and carious lesions (add pictures)
- To identify the need for referral to dental professionals.
- Provide details to the nearest facility

Transmission of *Streptococcus mutans*

- Caries is an infectious disease
- It can be spread through the sharing of toothbrushes or utensils
- Advise parents not to feed child with the same spoon they used to taste the child's food. They should also not test the child's bottle/ dummy by putting in their mouths before giving it to the child without cleaning it first.

Feeding practices

- Caries is an infectious disease
- All food (especially those with sugar) that cling to the teeth can cause tooth decay
- Milk contains a lot of sugar - especially breast milk
- Sweetened drinks also have a very bad effect on teeth
- After one year of age, feeding habits are more difficult to break.
- Bottle tips/ teats deposit substances directly onto the teeth (add illustration of a cross-sectional view of the mouth to illustrate the nipple of the bottle in contact with the upper teeth)
- Children need a balanced diet to ensure optimal growth and development
 - What constitutes a balanced diet? (Illustrate with food pyramid)
 - The effect of sweet foods in the diet
 - How can the diet be adapted to ensure better dietary balance?
 - Recommendation of healthier food choices

- Parents should be advised of the following:
 - Not to put sweet liquids in the bottle
 - Not to dip dummy/ pacifier in sugar or honey
 - To stop breast- and bottle-feeding by 1 year
 - Child should start drinking out of a cup or use a straw by 1 year of age
 - Sippy cups or sports bottles are just as bad as baby bottles as they have the same effect on teeth
 - Children can drink out of a cup or glass
 - No sweet drinks should be given between meals
 - After meals, if teeth cannot be brushed, rinse child's mouth or give water to drink

Oral hygiene practices

- Caries is an infectious disease caused by bacteria on the tooth surface
- In order to prevent caries, bacteria/ plaque must be removed from the tooth surface regularly
- Bacteria multiply more at night due to reduced saliva flow
- Children cannot brush their teeth properly until they are about 10 years old
- Young children cannot spit and will swallow the toothpaste
- Swallowing too much toothpaste can cause spots on the teeth (fluorosis).
- The child's overall fluoride exposure should be taken into consideration before prescribing fluoride supplements.
- Parents should be advised of the following:
 1. Parents must actively help children to brush their teeth until about 7 years. Between 7 and 10 years, they can supervise the brushing.
 2. Introduce oral hygiene practices early, before the first tooth erupts.
 3. Clean child's mouth after breast- or bottle-feeding. In children younger than 18 months, clean the child's mouth after feeds using gauze, cloth or soft children's toothbrush. Do not use fluoride toothpaste in these children.
 4. Clean the child's mouth before the child goes to sleep
 5. Do not give the child a bottle to drink at night
 6. From 2 years of age, use a soft children's toothbrush and children's toothpaste to clean the child's teeth.
 7. Back-and-forth scrubbing action is preferable in a child under 6 years. Thereafter, a circular motion is recommended.

8. After meals, if teeth cannot be brushed, rinse child's mouth or let them drink water

7.7.3 SCHOOLS (pictures/ illustrations will be added as indicated)

Teachers at each school should be provided with the contact details of the nearest dental treatment facility so that this information can be made available to parents and children with dental problems can be referred. Information about dental health should also be incorporated into life orientation/ health education modules at schools.

Teachers at preschools and crèches should be made aware of the following:

Transmission of *Streptococcus mutans*

- Caries is an infectious disease
- Children should not share utensils and toothbrushes

Feeding practices

- All food (especially those with sugar) that cling to the teeth can cause tooth decay-- No sweet drinks between meals. Drinking of water should be encouraged, especially after meals.
- Bottle tips/ nipples deposit substances directly onto the teeth-- Sippy cups or sports bottles should be discouraged. Children should drink out of a cup or make use of a straw
- In preschools where meals are provided, healthy food options e.g. fruit should be made available instead of sugary snacks. (Illustrate with food pyramid)

Oral hygiene practices

- Wherever possible, tooth brushing should be introduced into the children's routine.
- If this is not possible, rinsing should be encouraged especially after meals.

7.7.4 MANAGEMENT SYSTEMS

Management/ service issues that need to be put in place:

- Provide incentive for prevention by allowing practitioners to claim for these services
- Improved utilization of:
 - existing community service facilities and dentists
 - retired dental professionals
- Establish referral systems for dental treatment from community clinics/ nurses/ doctors
- Standardize education messages- all promotional material should go through a central committee/ dedicated arm of government health systems in order to organize and apply educational messages. Messages from the various professions need to be integrated (such as nutrition, HIV/ AIDS, dental health) so that all professions send out the same message e.g. messages on oral health and feeding practices can be integrated with prenatal care.
- Encourage yearly dental visits

Facilities/ physical barriers that need to be addressed:

- Train non-dental professionals/ nursing staff to perform simple oral examinations which take up minimal time (i.e. “lift-the-lip technique”) so that well-baby visits can be maximized and children in need of dental treatment can be referred.
- As an incentive for nurses, training sessions could take the form of CPD activities
- Provide community clinics with details of nearest dental treatment facility
- Introduce more preventive/ oral hygiene services at community clinics
- Provide dental clinics with more restorative equipment/ materials
- Dental treatment of children under 6 years of age at all health facilities should be free even for those children on medical aid. This includes tertiary institutions and community health centres which service the communities. At present, not all children are treated free of charge at these facilities as patients are placed into income categories depending on the salary bracket of their parents. In many cases, children of parents who have rudimentary medical aid are also not treated free of charge even though not all medical aid schemes cover preventive procedures. As far back as 1994 free medical care for children under 6 years of age as well as for pregnant mothers were promulgated. However, in practice, the situation with the provision of free dental care is somewhat more complicated. In the study area free dental care is theoretically available at clinics but this often translates into only tooth extraction services.
- All patients should have access to free dental advice

7.8 DEVELOPMENTS IN GETTING THE MESSAGE ACROSS AFTER STUDY COMPLETION

After completing the questionnaire regarding their knowledge of early childhood caries, the nurses in the paediatric wards of Tygerberg Hospital became more aware of the importance of oral health. The candidate was approached by two of the sisters in charge of the intensive care wards to provide an information session and oral hygiene demonstration. That is why the photographs accompanying this brief summary of the training was taken in an intensive care setting. Nurses in the paediatric wards were shown how to brush a child's teeth. Nurses were also made aware of what to look for when assessing the oral cavity so that they can refer patients promptly for dental treatment.

The nurses were asked if they knew what the cause of dental caries was—one of them reluctantly volunteered that it was the medication. It was then explained what causes caries, in particular early childhood caries and they were shown a series of pictures illustrating caries progression. It was emphasized that early detection and timely referral could prevent the development of more serious conditions like abscess formation and a potential life-threatening cellulitis.

As nurses found oral hygiene measures in the ventilator patients to be particularly challenging, additional time was spent teaching them how to manage these patients.

A group of approximately 8 nurses at a time was addressed and it was demonstrated how to clean the mouth of a child who was on a ventilator. These demonstrations prompted the request to be the contact person for dental matters and the candidate was asked to go through the Ventilator Assisted Patients (VAP) proposal so that sections where dentistry could have an input were identified. A protocol for oral care was drawn up which acted as a step-by-step guide for nurses to assist them with the incorporation of the oral health component into this programme.

CARIES PROGRESSION



The contents of the education session are summarized in the following section:

VAP bundle—Oral health component

Aim: removal of dental plaque (to be done thoroughly at least once daily)

Tools:

1. Gloves
2. Biteblocks/ finger guards
3. Chlorhexidine mouthrinse—swab mouth prior to brushing
4. Gauze squares
5. Suction tips
6. Toothbrushes (as an adjunct to swabs)—scrubbing technique
7. Toothpaste—pea-sized amount in the breadth of the toothbrush (suction NB in children < 6 years)
8. Bicarbonate of soda rinse (5ml bicarbonate for 250ml water)—high pH, disinfectant and antiseptic properties
9. Chlorhexidine gel eg. Paroex gel (±R52 per 75ml)—to be applied after completion of OH procedures
10. Vaseline
11. Cotton rolls/ ear buds

Method:

1. Place biteblocks wherever possible/ Use finger guards to prop open the mouth in order to gain better access to the oral cavity.
2. Swab entire mouth with gauze soaked in chlorhexidine rinse, making sure to rub tooth surfaces vigorously
3. Suction well
4. Where access can be obtained for toothbrush, use a scrubbing action back and forth on all tooth surfaces. Use minimal toothpaste.
5. Suction well
6. Clean the tongue wherever possible
7. Swab mouth with bicarbonate of soda rinse
8. Suction well
9. Apply chlorhexidine/ Paroex varnish/ gel to teeth using cotton rolls/ ear buds.

Squeeze out a small amount onto a paper square to prevent cross-contamination.

10. Apply Vaseline to patient's lips

Other concerns regarding dental health

- Gastric feeding tubes (oral placement)
- Reflux of gastric contents

NB!! Swab mouth after feeds with bicarbonate rinse

Look out for:

- Cavities (including discolourations)
- Soft tissue lesions (swellings, abscesses, ulcers)

Patients who are conscious and able to rinse and spit should do so at regular intervals, especially after feeds. ↑ water intake in patients who are able to take fluids.

The candidate also assisted with the procurement of toothbrushes and toothpaste for this ward as part of the VAP (ventilator-assisted patient) programme roll-out. These sessions with the nurses helped to raise awareness of the importance of oral health and caries prevention. Thus far, feedback has been positive and future contact sessions are in the pipeline. There is also a move afoot to try and make the protocol “standard operating procedure” at the hospital so that it can be implemented in all the wards. This is a small step in the right direction. With minimal training and guidance, nurses can play an invaluable role in the prevention of early childhood caries.



Figure 7.8.1: Demonstrating various oral hygiene aids to the nurses



Figure 7.8.2: Demonstrating various oral hygiene aids to the nurses



Figure 7.8.3: Demonstrating how to clean the mouth of a child on a ventilator. These basic principles can be applied to other children in the hospital as well.

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ADDENDUM

Appendix A: Data capture sheet

SITE: _____

No.	SEX	AGE	CARIES DISTRIBUTION
			<div style="display: flex; justify-content: space-between; padding: 5px;"> NC ECC Caries free Pain </div> <p>Other:</p> <p>Mx: _____</p> <p>Md:</p>
			<div style="display: flex; justify-content: space-between; padding: 5px;"> NC ECC Caries free Pain </div> <p>Other:</p> <p>Mx: _____</p> <p>Md:</p>

Appendix B: Participant information leaflet and consent form (Parents)

TITLE OF THE RESEARCH PROJECT:

An investigation of the practices and knowledge of parents and caregivers regarding nursing caries in children, in order to plan a community appropriate intervention strategy.

PRINCIPAL INVESTIGATOR: Dr. N. Mohamed

ADDRESS: P. O. Box 16
Gatesville
7766

CONTACT NUMBER: (021) 937 3073 or 937 3056/ 7 [W]/ 083 2705 105

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the doctor any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the Committee for Human Research at Stellenbosch University and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

General Information about the project

Parental care-giving choices and behaviour seems to be largely responsible for the high incidence of nursing caries. This is especially evident in economically disadvantaged areas.

The purpose of this study is to investigate the factors (behavioural, social and environmental) that are specific to children presenting with nursing caries and to gain insight into the

practices and knowledge of their parents. The information gathered will be used to plan community appropriate intervention strategies to address the nursing caries problem.

Participants

In-depth interviews will be conducted with parents of children under 6 years of age attending various community clinics, immunisation clinics and baby wellness clinics in economically disadvantaged areas. Only parents who are able to speak English or Afrikaans will be invited to participate as the researcher is only able to speak these two languages. A structured questionnaire will be used to record responses.

Participation in this study is **voluntary** and **totally anonymous**. Consent forms will be separated from the data capture sheets to preserve anonymity. All information will be regarded as **strictly confidential**.

Financial implications

The purpose of this study is purely to gather information about parental habits and knowledge. No personal benefits (participants and researcher) will be derived from this research.

For further information

- **You can contact Dr N. Mohamed at tel 083 2705 105 if you have any further queries or encounter any problems.**
- **You can contact the Committee for Human Research at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by your study doctor.**
- **You will receive a copy of this information and consent form for your own records.**

Declaration by participant

By signing below, I agree to take part in this research study entitled: An investigation of knowledge of health care workers and the type of information being disseminated regarding nursing caries in children, in order to plan a community appropriate intervention strategy.

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.

Signed at (*place*) on (*date*) 20...

.....
Signature of participant

.....
Signature of witness

Declaration by investigator

I , Dr. Nadia Mohamed, declare that:

- I explained the information in this document to the participant.
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above

Signed at (*place*) on (*date*) 20....

.....
Signature of investigator

.....
Signature of witness

Appendix C: Full questionnaire (Parental interview)

The purpose of this questionnaire is to gain insight into the practices and knowledge of parents regarding nursing caries in children.

INFORMATION REGARDING CHILD (younger than 6 years) WITH/ WITHOUT NURSING CARIES (Please circle relevant term)

1. **Gender:** Male (M) Female (F)
2. **Age:**
3. **Caries risk (according to CAT):** High (H) Moderate (M)
Low (L)
4. **Has the child been to a dentist before?** Y N
5. **Age at first dental visit:**
6. **Previous dental treatment received by child:** extractions (E)
restorations (R)
7. Do you believe in fillings? Y
N:.....
8. Is the child **healthy**? Y N
9. Was the child born prematurely? Y N
10. Were there any complications at birth? Y: N
11. **Bottle-feeding** (bottle/ feeder-cup/ energade bottle) Y N
12. **Bottle contents:** sweetened unsweetened
eg.:.....
13. **Bottle:** Day (D) Night (N)
14. Were the child's teeth brushed after the last feeding? Y
N
15. Did you know that the bottle is bad for the teeth? Y N
16. **Bottle:** Age stopped=
17. **Breast-feeding** Y N
18. **Breast:** Age stopped=
19. Was the bottle/ breast used as a method of **behaviour control**? Y
N
20. **Use of dummy:** Y N
21. **Dummy:** sweetened unsweetened eg.:

22. Did you know you can catch cavities by sharing the same spoon or toothbrush?

Y

N

23. Is the child's **diet** very cariogenic? Y: eg.:..... N

24. Frequency of **sweet** foods in diet: **every day** **once a week**

now and then

25. Who **brushes** the child's teeth? **Parent** **child** **NO brushing**

other:

26. Does the child use toothpaste? Y: **brand=**

N

27. How often are the child's teeth brushed? **1 x a day** **more than 1 x a day**
day **never**

28. At what age was oral hygiene introduced?

29. Did anyone teach you how to care for your teeth? Y N

30. How often do you visit the dentist?

PARENTAL INFORMATION

31. **Accompanying adult:** mother father

other:.....

32. **Age of parent:**years

33. Till what standard did parent go to school?

34. **Marital status:** Single (S) Married (M) Divorced (D)

Living together (LT)

35. What work do you do?

36. How many adults in your home?

37. No. of adults with permanent job?

38. No. of adults with casual job?

39. No. of adults unemployed?

40. No. of adults receiving grant/ disability?

41. No. of children in your family?.....

42. Who looks after the children during the day?.....

Appendix D: Data capture sheet (Parental interview)

PARENTAL PRACTICES AND KNOWLEDGE

Patient number				
1	Gender (M/F)			
2	Age			
3	CAT risk (H/M/L)			
4	Prev. Rx (Y/N)			
5	Age dental visit			
6	Prev Rx (E/ R)			
7	Fillings good?			
8	Child healthy?			
9	Premature?			
10	Birth complic.			
11	Bottle-fed			
12	Content sweet?			
	Eg.			
13	Bottle: when (D/N)			
14	OH after feed			
15	Bottle vs caries			
16	Bottle stopped			
17	Breastfed			
18	Breast stopped			
19	Beh. Control			
20	Dummy			
21	Dummy sweet			
	Eg.			
22	Sharing			
23	Sweet diet			
	Eg.			
24	Freq of sweet			
25	Who brushes			
26	Toothpaste			
	Eg.			
27	Freq. brush			
28	Age OH intro			
29	OH education			
30	Freq dent visits			
31	Accomp. Adult			
32	Parental age			
33	School std.			
34	Marital status			
35	Nature of job			
36	Adults in home			
37	Permanent job			
38	Casual job			
39	Unemployed			
40	Grant/ disability			
41	No. of kids			
42	Caretaker (day)			
ADDITIONAL COMMENTS				

Appendix E: Participant information leaflet and consent form (HCW)

TITLE OF THE RESEARCH PROJECT:

An investigation of knowledge of health care workers and the type of information being disseminated regarding nursing caries in children, in order to plan a community appropriate intervention strategy.

PRINCIPAL INVESTIGATOR: Dr. N. Mohamed

ADDRESS: P. O. Box 16

Gatesville

7766

CONTACT NUMBER: (021) 937 3073 or 937 3056/ 7 [W]/ 083 2705 105

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the doctor any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the Committee for Human Research at Stellenbosch University and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

General Information about the project

The large numbers of children afflicted with nursing caries is a very real problem which seems to have reached epidemic proportions especially in economically disadvantaged areas. Health care workers at immunization and well-baby clinics are usually the first health professionals to come into contact with children and seems logical that they can play an important role in the prevention of nursing caries. The purpose of this study is to investigate

the knowledge of health care workers and the type of information being disseminated regarding nursing caries in children in order to plan a community appropriate intervention strategy.

Participants

Staff at various community clinics, immunisation clinics and baby wellness clinics in disadvantaged areas who have direct patient contact will be approached to participate in the study. Only health care workers at the clinics who are able to speak English or Afrikaans will be invited to participate as the researcher is only able to speak these two languages. Questionnaires will be distributed for staff to complete in their own time.

Participation in this study is **voluntary** and **totally anonymous**. Consent forms will be separated from the data capture sheets to preserve anonymity.

Financial implications

The purpose of this study is purely to gather information in order to plan a community appropriate intervention strategy to address the problem. No personal benefits (participants and researcher) will be derived from this research.

For further information

- **You can contact Dr N. Mohamed at tel 083 2705 105 if you have any further queries or encounter any problems.**
- **You can contact the Committee for Human Research at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by your study doctor.**
- **You will receive a copy of this information and consent form for your own records.**

Declaration by participant

By signing below, I agree to take part in this research study entitled: An investigation of knowledge of health care workers and the type of information being disseminated regarding nursing caries in children, in order to plan a community appropriate intervention strategy.

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurized to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.

Signed at (*place*) on (*date*) 20.....

.....

Signature of participant

.....

Signature of witness

Declaration by investigator

I, Dr. Nadia Mohamed, declare that:

- I explained the information in this document to the participant.
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above

Signed at (*place*) on (*date*) 20.....

.....

Signature of investigator

.....

Signature of witness

Appendix F: Full questionnaire (Health care workers)

The purpose of this questionnaire is to gain insight into the knowledge of health care professionals regarding nursing caries in children.

INFORMATION: To be filled in by **Health Care Professionals (Outside the dental profession)**

1. **Gender:** male/ female
2. **Occupation:**
3. **Qualification/s:** **degree** **diploma**
4. **Place where tertiary education was obtained:**
5. **General:**
 - a. On a scale of 1 to 10, how important is dental health?
 - b. How often do you visit the dentist?
 - 1 x year
 - more than 1 x a year
 - only when there is a problem
 - never
 - c. Do you know what causes cavities? **Y** **N**
 - d. Do you know how cavities can be prevented? **Y** **N**
 - e. At what age do you think a child should visit the dentist for the first time?
.....months/ years
 - f. Do you know what fluoride is and what it does? **Y** **N**
 - g. Have you heard of nursing caries? **Y** **N**
If YES,
 - Do you know what causes nursing caries? **Y** **N**
 - Do you know how nursing caries can be prevented? **Y** **N**
 Where did you gain this knowledge from?
 - h. Do you think milk teeth are important? **Y** **N**
If NO, why not?.....
 - i. Should milk teeth be restored? **Y** **N**
 - j. Do you inform parents that there are sugar-free medications available? **Y**
N
 - k. Where did you learn about basic childcare?

10. **Well-baby visits:**

- a. Do you routinely perform oral examinations on children? **Y** **N**
Reason?.....
- b. Do you think it is a good idea to incorporate a dental examination into the routine examination?
Y **N**
Reason?.....
- c. Do you think that your knowledge of oral health in terms of general health is:
Adequate lacking
- d. Do you think it is a good idea to incorporate basic dental examinations and current preventive practices in undergraduate curricula? **Y** **N**
Reason?.....